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Sandia Canyon Assessment Unit NM-9000.A_047 Dissolved Copper 4B Demonstration

Prepared by the Environment, Safety and Health Directorate

EXECUTIVE SUMMARY

The state of New Mexico Clean Water Act (CWA) §303(d)/§305(b) Integrated Report (hereafter, the Integrated Report) satisfies the statutory requirements of §303(d), §305(b), and §314 of the federal Water Pollution Control Act. The Integrated Report presents basic information on water quality and water pollution control programs in New Mexico to the U.S. Environmental Protection Agency (EPA) and the U.S. Congress as well as to the general public. The Integrated Report is first approved by the New Mexico Water Quality Control Commission, after which it is submitted to EPA Region 6 by April 1 of every even-numbered year.

The core of the Integrated Report is the CWA §303(d)/§305(b) Integrated List. In accordance with the EPA integrated listing guidance, the state of New Mexico listed the Sandia Canyon water quality Assessment Unit (AU) NM-9000.A_047 (upper Sandia Canyon AU), located in upper Sandia Canyon near Los Alamos, NM, in the 2012–2014 Integrated Report as not supporting coldwater aquatic life, livestock watering, and wildlife habitat designated uses. Further, the AU was assigned a Category 5C status. Assessment Units assigned Category 5 constitute New Mexico's CWA §303(d) List of Impaired Waters. Section 303(d) and supporting regulations require the state of New Mexico to develop a total maximum daily load (TMDL) for each impaired AU-pollutant combination. TMDLs establish pollution reduction goals and load allocations necessary for impaired water to attain applicable water-quality standards (WQS). The upper Sandia Canyon AU was assigned to Category 5C because concurrent-hardness data were not available at the time of assessment. Concurrent-hardness data need to be used, when available, to verify any cause of impairment that is a result of applying hardness-dependent criteria.

One of the parameters determined to be associated with the AU NM-9000.A_047 impairment is dissolved copper. This document presents information provided by the U.S. Department of Energy (DOE) and Los Alamos National Security, LLC (LANS) to the New Mexico Environmental Department (NMED) to justify changing 303(d) listings to Category 4b status for AU NM-9000.A_047–dissolved copper pollutant pair. A 4b status identifies an AU as impaired or threatened for one or more designated uses but does not require developing a TMDL because other pollution control requirements are reasonably expected to result in the attainment of the WQS in the near future.

EPA regulations recognize that alternative pollution control requirements that are stringent enough, in place, and monitored may make developing a TMDL unnecessary because both mechanisms would essentially achieve the same surface water-quality goal. Specifically, TMDLs are not required if technology-based effluent limitations, more stringent effluent limitations, or other pollution control requirements (e.g., best management practices) required by local, state, or federal authority are stringent enough to implement an applicable WQS [see 40 Code of Federal Regulations 130.7(b)(1)] within a reasonable period of time. Impaired water with adequate alternatives to TMDLs in place are commonly referred to as "Category 4b waters".

The upper Sandia Canyon AU dissolved copper 4b Demonstration (hereafter, the 4b Demonstration) provides the justification that regulatory controls, currently in place and planned, are stringent enough to implement applicable WQS. Readily-available data used to both develop the upcoming 2014 Integrated Report and support this 4b Demonstration were collected from watershed-based monitoring locations from May 2008 to May 2013. These data include dissolved copper and concurrent hardness.

The AU addressed in this 4b Demonstration consists of the Sandia Canyon reach within Los Alamos National Laboratory property between National Pollutant Discharge Elimination System– (NPDES-) permitted outfall 001 and Sigma Canyon. This reach receives perennial flows generated primarily from an industrial outfall (NPDES Outfall 001). Three separate NPDES permits which provide a regulatory framework, along with completion of the Sandia Wetland Stabilization Project to reduce potential

migration of contaminated wetland sediments, provide the necessary controls for eventual attainment of the dissolved copper WQS in the upper Sandia Canyon AU. These improvements make the upper Sandia Canyon AU–dissolved copper pollutant pair an ideal candidate for consideration under the 4b Demonstration.

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1. IDENTIFICATION OF ASSESSMENT UNIT AND STATEMENT OF PROBLEM CAUSING THE IMPAIRMENT

Appendix 1 contains a map of the Sandia Canyon watershed, located within Los Alamos National Laboratory (the Laboratory). The map shows the two assessment units (AUs) within Sandia Canyon, defined by the New Mexico Environment Department (NMED) from National Pollutant Discharge Elimination System (NPDES) Outfall 001 east to NM 4. The 4b Demonstration covers the upper Sandia Canyon AU, which consists of the Sandia Canyon reach within Laboratory property between NPDES Outfall 001 and Sigma Canyon. This AU represents the upper portion of Sandia Canyon with perennial flows generated primarily from NPDES Outfall 001. The AU is described in the state of New Mexico 2012–2014 Clean Water Act (CWA) §303(d)/§305(b) Integrated Report (1) and is equivalent to "water quality-limited segment." The state of New Mexico specifically defines the term "segment" within the state water-quality standards (WQS) at 20.6.4.7 New Mexico Administrative Code (NMAC) Subsection S Paragraph (2). In New Mexico, there are generally many AUs within a WQS segment (20.6.4.97 through 20.6.4.899 NMAC).

1.1 Assessment Unit Description

The demonstration should identify the impaired assessment unit, including name, general location and State-specific location identifier.

- AU Name: Upper Sandia Canyon AU (NPDES Outfall 001 to Sigma Canyon)
- AU ID: NM-9000.A_047
- 2.21-mi reach comprised primarily of discharge from NPDES Outfall 001

This segment of Sandia Canyon, located in the main Laboratory Technical Area 03 (TA-03), begins at an elevation of approximately 7,300 ft at a location where perennial flows are generated largely from NPDES Outfall 001. The segment extends downstream for 2.21 mi to the confluence with Sigma Canyon. Overall, the drainage area for this AU is approximately 1.3 mi^2, encompassing Laboratory property, private property, and the now-closed Los Alamos County landfill.

Three NPDES Permits provide coverage for current and historical activities in the AU:

1. The Industrial Point Source Permit (IPSP, NPDES Permit No. NM0028355) covers three outfalls,
2. The Storm Water Individual Permit (IP, NPDES Permit No. NM0030759) covers thirteen Resource Conservation and Recovery Act (RCRA) solid waste management units (SWMUs) and areas of concern (AOCs) associated with historical Laboratory activities, and
3. The Storm Water Multi-Sector General Permit (MSGP, NPDES Permit Tracking No. NMR05GB21) covers seven ongoing operational industrial facilities subject to this EPA general permit.

This AU is classified as perennial water (20.6.4.126 NMAC) and has designated uses of coldwater aquatic life, livestock watering, wildlife habitat, and secondary contact (2).

1.2 Impairment and Pollutant Causing Impairment

The demonstration should identify the applicable water quality standards not supported and associated pollutant causing the impairment.

According to the draft 2014-2016 CWA §3039(d)/§305(b) Integrated List, the following WQS are not supported:

Designated Use Not Supported	Parameter with Associated WQS	Sandia Canyon (Sigma Canyon to NPDES outfall 001)
Coldwater AL	Dissolved Copper-Acute AL	NS

Notes: AL = aquatic life, NS = Nonsupport.

1.3 Sources of Pollutant Causing the Impairment

The demonstration should include a description of the known and likely point, nonpoint, and background (upstream inputs) sources of the pollutant causing the impairment, including the potential magnitude and locations of the sources. In cases where some portion of the impairment may result from naturally occurring sources (natural background), the demonstration should include a description of the naturally occurring sources of the pollutant to the impaired assessment unit.

1.3.1 Point Source Locations and Potential Magnitudes

1.3.1.1 Industrial Point Source Permit (IPSP) Outfalls

The IPSP Discharge Permit is currently the only active NPDES Industrial and Sanitary Outfall Discharge Permit at the Laboratory. A new permit was issued on August 15, 2014 and has an effective date of October 1, 2015 to September 30, 2019. The IPSP Permit includes 11 outfalls, three of which discharge to the upper AU. The locations of these outfalls are shown in the map in Appendix 1.

Three outfalls, permitted under the NPDES IPSP, discharge to the AU, as presented in Table 1 below. The location of these outfalls is shown on the map contained in Appendix 1. NPDES Outfall 001, which is the main effluent source of water to the AU, averages approximately 268,000 gal./d from treated sanitary and power plant effluent. Cooling tower outfalls 03A027 and 03A199 contribute less than 100,000 gal./d combined.

Table 1
Industrial Point Source Permit Outfalls Discharging to the Upper Sandia AU

Outfall Category	ID No.	Location/ Facility	Watershed
Power Plant/Sanitary Effluent Reclamation Facility (SERF) Discharge (001)	001	TA-3-22	Sandia
Treated Cooling Water (03A)	03A027	TA-3-2327	Sandia
Treated Cooling Water (03A)	03A199	TA-3-1837	Sandia

The current NPDES permit, issued in August 2007, did not include effluent limitations for copper at Outfalls 001, 03A027, and 03A199 because there was not a reasonable potential for a WQS exceedance.

Table 2 provides a summary of copper data for Outfalls 001, 03A027, and 03A199 for the period from 2008 to 2013.

The one data point for copper at 03A199 indicates a reasonable potential may exist for exceedance of the chronic copper WQS. Consequently, if an effluent limit is established at this outfall, it will be managed through the IPSP. Chronic aquatic life criteria are applied to these outfalls because the effluent from Outfall 001 creates a perennial portion within Sandia Canyon. Releases from Outfalls 03A027and 03A199 are below Outfall 001.

Table 2
Copper Data for Outfalls 001, 027, and 199

Monitoring Location	Min (µg/L)	Max (µg/L)	Mean (µg/L)	Median (µg/L)	No. of Samples	Hardness[a] (mg/L)
Outfall 001	1.6	3.2	2.3	2.3	9	78.8
Outfall 027	1.2	2.9	2.0	—[b]	5	78.8
Outfall 199	—[c]	13.2	—[c]	—[c]	1	122.0

[a] Effluent hardness value.

[b] Data not sufficient to calculate median.

[c] Only one data point available.

The new IPSP was issued on August 15, 2014 and as a condition of certification, NMED issued a state certification on September 19, 2013 requiring the permit to control copper pollutants which were above the current EPA Region 6 Minimum Quantification Level or MQL (0.5 ug/L) with effluent limitations at the Chronic Aquatic Life criteria in Outfall 001, 027 and 199 to ensure that NPDES permits are protective of State WQS. Hardness effluent characteristic of the discharge from Outfall 001 (78.8 mg/L) was used at all three outfalls to represent the receiving stream hardness and calculate the effluent limitations for the certification.

1.3.1.2 Point Sources Covered Under the Storm Water Individual Permit (IP)

The IP authorizes discharges of storm water associated with industrial activities from specified SWMUs and AOCs. A SWMU is a discernible unit at which solid wastes may have been “routinely and systematically released” and could result in a release of hazardous constituents. The Sites regulated under the IP are a subset of the SWMUs and AOCs that are being addressed under the March 2005 Compliance Order of Consent (the Consent Order) (3). The Consent Order fulfills the corrective action requirements in §3004(u) and §3008(h) of RCRA.

For purposes of monitoring and management under the IP, Sites are grouped into small watersheds called site monitoring areas (SMAs). An SMA is a single drainage area within a subwatershed and typically includes more than one Site. The IP treats the potential historical releases at a Site as an “industrial activity” that creates a “point source discharge” and directs the Permittees to monitor storm water discharges from Sites at specified SMAs. Storm water from a Site may drain to multiple subwatersheds and may be associated with multiple SMAs.

The conceptual map example in Figure 1 below shows the relationship between SWMUs and AOCs and the SMA boundary. Sampling occurs at the SMA level: a single drainage within a subwatershed which may include one or more SWMU or AOCs.

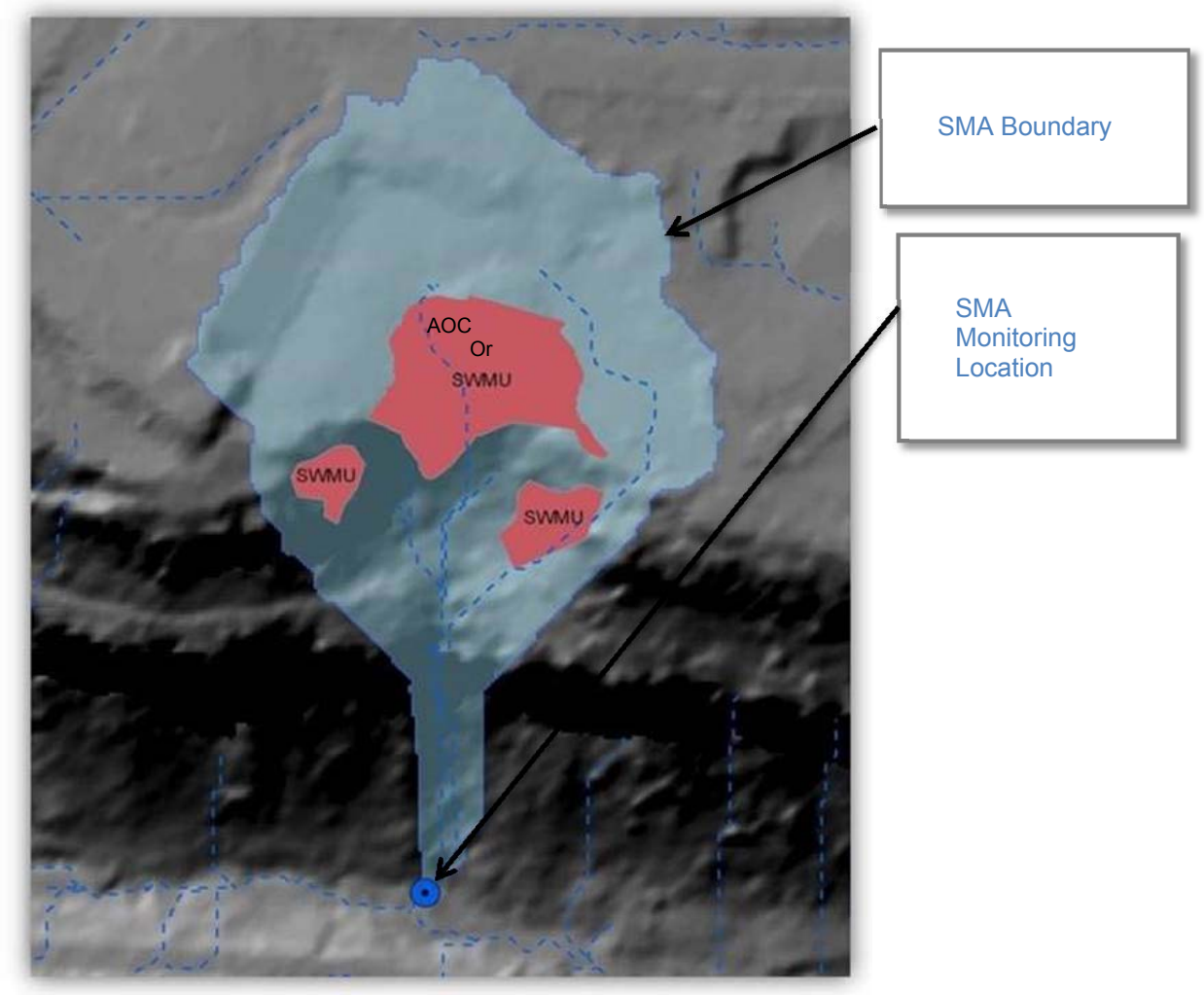

Figure 1 Relationship Between SWMU, AOC and SMA Boundary

A Site that met the definition of a SWMU or AOC was evaluated for inclusion in the IP based on the following criteria:

1. The SWMU/AOC is exposed to storm water (e.g., not capped or subsurface);
2. The SWMU/AOC contains “significant industrial material” (e.g., not cleaned up or has contamination in place); and
3. Potentially impacts surface water. The selection of SWMUs and AOCs for inclusion in the IP was based on storm water, sediment, and soil data available at the time the permit application was submitted.

Under the Consent Order, SWMUs or AOCs are investigated in a phased approach by aggregate area until the nature and extent of contamination from any historical release at a SWMU or AOC have been defined in all relevant media. The upper Sandia Canyon Aggregate Area is located in TA-03, TA-60, and

TA-61 with a boundary approximately equal to the upper Sandia Canyon AU. Thirteen Sites within this aggregate area are permitted under the IP. These thirteen Sites are grouped into nine SMAs.

The investigation results are compiled in an investigation report which includes a risk assessment. If the risk assessment demonstrates that the site poses no unacceptable risk to human health or the environment under current and reasonably foreseeable future land use, DOE/LANS will submit a request for a Certificate of Completion (CoC) with or without controls, as appropriate. DOE/LANS may perform remediation activities and confirmation sampling before they request a CoC. A CoC is requested only after NMED has approved the investigation report.

On the other hand, if the site is complex and cannot be remediated to residential risk levels, DOE/LANS may be required to prepare corrective measures evaluation (CME) report. Typically, a CME may be required for Sites with buried waste, vadose zone contamination, and/or groundwater contamination. The CME is used to identify, develop, and evaluate potential remedial alternatives for removal, containment, and/or treatment of contamination. Upon approval of the CME report, NMED will select a remedy or remedies for the Site and issue a Statement of Basis for public comment. NMED will select a final remedy and issue a response to public comments within 90 days or other appropriate time after the conclusion of the public comment period. The Consent Order also provides an opportunity for public hearing.

The investigation and remediation of SWMUs and AOCs under the Consent Order began before the effective date of the IP and continues concurrently with implementation of the IP. A significant amount of new (post-IP) soil data have been collected under the Consent Order that have allowed the Laboratory to refine some of the initial assumptions regarding the presence of significant industrial materials in soil exposed to storm water (4, 5). Copper is a chemical of potential concern (COPC) at SWMUs 03-13(i), 03-014(c2) and AOC C-61-002. SWMUs 03-45(b), 03-045(C2), and 03-014(c) are covered under the IP.

Storm water from AOC C-61-002 does not impact dissolved copper concentrations in the AU. In a Consent Order investigation, copper was detected in samples collected at depth found to be above background values but below residential soil screening levels (SSLs). The site poses no potential unacceptable risks for industrial, construction worker, or residential scenarios or to ecological receptors.

Under the Consent Order, additional sampling at SWMU 03-013(i) was proposed in the Upper Sandia Canyon Aggregate Area Supplemental Investigation Report to define extent of contamination. Copper was detected above the soil background value but below residential soil screening levels (SSLs).

The selection of SWMUs and AOCs for inclusion in the Individual Permit was based on historical information and any storm water, sediment, and soil data available at the time the Permit application was submitted. As indicated above, a Site that has met the definition of a SWMU or AOC was evaluated for inclusion in the current Individual Permit based on the following criteria: (1) the SWMU/AOC is exposed to storm water (e.g., not capped or subsurface); (2) the SWMU/AOC contains “significant industrial material” (e.g., not cleaned up or has contamination in place); and (3) the SWMU/AOC potentially impacts surface water. Through this conservative selection process, 405 Sites were selected for inclusion in the IP and the remaining sites were determined to not be a potential source to surface water. The remaining Sites are therefore not monitored for storm water as there is no storm water monitoring requirement under the Consent Order.

Data collected under the Consent Order for these thirteen Sites are evaluated in the Upper Sandia Aggregate Area Supplemental Investigation Report (6), which was submitted to NMED Hazardous Waste Bureau on August 27, 2013. As summarized in Table 3, copper was not identified in the site description

as a significant industrial material historically used at any of the Sites in this AU. The Individual Permit treats a Site as an "industrial activity" that may create a "point-source discharge" and directs the Permittees to monitor storm water releases from Sites at specified sampling points (SMAs). As discussed above, the Site selection process conservatively identified Sites where routine and systematic releases of constituents historically managed at the Site may have occurred, consistent with the RCRA definition and the Site itself is exposed to storm water. Consent Order soil data, which was collected after the Sites were selected for inclusion in the IP, is used to determine if significant industrial materials were historically released in surface soils (i.e.; to a depth of three feet).

Storm water monitoring for metals, including copper, is required at all thirteen sites. The IP establishes target action levels (TALs) that are equivalent to New Mexico State water-quality criteria. These TALs are used as benchmarks to determine the effectiveness of control measures implemented under the IP. The map in Appendixes 1 and 2 show the locations of the SMAs in the AU. The Laboratory has been collecting storm water samples under the IP since the spring of 2011.

Monitoring and runoff controls are implemented per the IP, as applicable. For those sites not under the IP, investigation and characterization, risk assessment and appropriate remediation will be conducted per the Consent Order, providing full protection of human health and the environment.

1.3.1.3 Point Sources Covered Under the Storm Water Multi-Sector General Permit (MSGP)

The MSGP regulates storm water discharges from identified industrial activities and their associated facilities. Currently, there are seven MSGP-regulated facilities with the potential to discharge storm water to the AU. Four of the seven are located immediately adjacent to upper Sandia Canyon. The other three MSGP facilities convey runoff to upper Sandia Canyon via the Laboratory's storm drain infrastructure. Table 4 lists the seven MSGP sites, along with the monitored outfalls for each facility, their impaired water monitoring constituents, and the current monitoring status. The map in Appendix 1 shows the location of the MSGP sites.

MSGP-regulated industrial activities within the AU include metal fabrication, vehicle and equipment maintenance, recycling activities, electricity generation, and warehousing activities. EPA has identified potential pollutants, such as copper, applicable to the regulated activities. For each identified potential pollutant, the MSGP stipulates a pollutant benchmark concentration that may be applicable to a storm water discharge. Per the MSGP, copper is identified as a potential pollutant at only one of the MSGP facilities: the TA-60 Material Recycling Facility (E122.35).

For each type of industrial activity regulated by the MSGP, the MSGP identifies specific constituents required to be analyzed for in the permit-required storm water monitoring (i.e., potential pollutant for that activity). The MSGP then stipulates a pollutant benchmark concentration for that potential pollutant. Per the MSGP, copper is identified as a potential pollutant at two of LANS's MSGP facilities: the TA-60 Material Recycling Facility (MSGP Sector N – Scrap Recycling Facilities) and the TA-3-66 Sigma Complex (MSGP Sector F – Primary Metals). In addition to monitoring for the MSGP specified potential pollutants, if an industrial facility discharges to an impaired water body the MSGP requires monitoring for all pollutants for which the water body is impaired. Therefore, storm water monitoring for total copper is conducted at all the MSGP facilities discharging to Sandia Canyon.

Per the requirements of the current MSGP, which was issued on September 29, 2008, storm water monitoring was initiated in April 2009. Based on monitoring results since April 2009, and in accordance with the MSGP requirements, additional monitoring for copper has been eliminated at all the MSGP

facility outfalls that have had storm water discharges to the Sandia Canyon AU. This reduction in sampling has been achieved through successful management of processes and pollutant sources, and by documenting that copper values identified in storm water discharges were below either MSGP benchmark or background levels.

The permit period was from September 29, 2008 to September 29, 2013. LANL continues to operate under the 2008 MSGP under EPA issued Administrative Continuance until a new permit is issued. Due to the semi-arid climate and seasonal freezing conditions in Los Alamos, and in accordance with Section 6.1.6 of the MSGP, a quarterly storm water monitoring period from April 1 – November 30 was established. Quarters were identified as two-month periods (Apr-May, June-July, Aug-Sept, Oct-Nov). At each facility monitoring was performed during these periods from April 2009 until the permit requirements authorizing the discontinuation of monitoring were met. These dates are identified in the updated Table 4. Per MSGP requirements, monitoring for copper has been eliminated at all the MSGP facility outfalls that have had storm water discharges to the Sandia Canyon AU. This reduction in sampling has been achieved by eliminating processes and pollutant sources, and by documenting that pollutants are below benchmark or background levels.

Table 3
Upper Sandia Canyon AU Site Monitoring Areas (S-SMA) Authorized to Discharge under Storm Water Individual Permit NM0030579

SMA	Site ID	Site Description	AU	Site Monitoring Requirements[1]	Is Site a Potential Source of Copper?	Dissolved Copper (Cu) TAL Exceedance	IP Status[2,3] (as of 12/31/2012)
S-SMA-0.25	03-013(a)	A 1500-ft-long corrugated metal pipe (CMP) storm drain that served building 03-0038. The storm drain ran underground around building 03-0038, east along the south side of the Otowi Building (building 03-0261) and connected to four other storm drains before daylighting 100 ft east of the Otowi Building where it became an open concrete- and rock-lined ditch. Most of the CMP associated with SWMU 03-013(a) was removed in 2004 to accommodate the construction of the NSSB (03-1400) and a new parking structure (03 1402) east of the Otowi Building. The excavated CMP was managed as nonhazardous/nonradioactive industrial waste. Inspection of the drain line trench showed no evidence of a release from the drainpipe. A new storm drain pipe was installed west of SWMU 03 052(f) to manage storm water runoff from the new parking structure. The new storm drain discharges to the SWMU 03 052(f) outfall. Potential contaminants associated with industrial materials historically managed at this Site are metals and petroleum products. The SMA sampler associated with 03-013(a) receives runoff from a large storm drain system that captures runoff from roof drains, roads, and parking areas from a 33-acre developed area consisting of approximately 50% of TA-03. The concentration of copper detected in the SMA samples is less than the developed area background UTLs, consistent with the Site not being the source of these TAL exceedances.	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, Cyanide, Metals, polychlorinated biphenyls (PCBs), and semivolatile organic compounds (SVOCs)	No. Copper is not known to be associated with industrial materials historically managed at the Site. No data are available, and Consent Order sampling has been delayed until the demolition of building 03 1400 and structure 03 1402	Yes; 9.7-10.9 µg/L Cu detected.	In corrective action; enhanced controls installed (Q2 2013); A request for alternative compliance that included this site was submitted to EPA on April 30, 2013 and EPA's response was issued on March 27, 2014. EPA stated in its findings and determinations that this site was eligible for completion of corrective action under Part I.E.2 (i.e.: control measures that totally eliminate exposure of pollutants to storm water).The Permittees will submit a certification of completion of corrective action to EPA in accordance with this Part.
	03-052(f)	A formerly permitted outfall (EPA 03A023) that received wastewater from floor drains, sinks, water fountains, and a storm drain, which served building 03-0038 until 1987 when the drains in building 03-0038 were rerouted to the TA-03 sanitary sewer system. Potential contaminants associated with industrial materials historically managed at this Site are volatile organic solvents, petroleum products, and metals included in discharges from the maintenance contractor's shop in building 03-38 and three reported petroleum hydrocarbon spills. The only discharge to the outfall since 1987 is storm water runoff from parking lots and the surrounding areas in the north-central portion of TA-03 including the SWMU 03-013(a) storm drain. Outfall 03A023 was removed from the NPDES permit on July 11, 1997. The SMA sampler associated with 03-013(a) receives runoff from a large storm drain system that captures runoff from roof drains, roads, and parking areas from a 33-acre developed area consisting of approximately 50% of TA-03. The concentration of copper detected in the SMA samples is less than the developed area background UTLs, consistent with the Site not being the source of these TAL exceedances.	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, and PCBs	No. Copper is not known to be associated with industrial materials historically managed at the Site. Copper was detected above BVs in 9 of 14 shallow Consent Order samples at a maximum concentration 2.1 times the tuff BV.	Yes; 9.7-10.9 µg/L Cu detected.	In corrective action; a request for alternative compliance that included this site was submitted to EPA on April 30, 2013 and EPA's response was issued on March 27, 2014. EPA established a new compliance date of 10/31/2015 for this site. The Site meets industrial and construction worker risk levels and was recommended for a CoC with controls. SWMU 03-052(f) was included in the Supplemental Investigation Report for the Upper Sandia Canyon Aggregate Area, submitted to the NMED under the Consent Order on August 27, 2013.
S-SMA-1.1	03-029	SWMU 03-029 is a 30-ft × 70-ft purported former landfill located near the rim of Sandia Canyon at TA-03. This landfill reportedly received excess asphalt from the batch plant and was subsequently covered with sand, however during surveys in 2005, no buried asphalt was encountered. Potential contaminants associated with industrial materials historically managed at this Site are petroleum products associated with asphalt. Dense grass cover was established and maintained on all fill slopes and disturbed areas. Water samples collected from the storm drain indicated that oil, grease, or other chemicals typically associated with asphalt plant operations were not present indicating the effectiveness of the corrective action. The asphalt batch plant operated at TA-03 from 1953 to 1990. The SMA sampler receives runoff primarily from developed areas (buildings, parking lots, roads, and a former salvage yard (SWMU 03-059) as well as from landscape consisting of Bandelier Tuff sediment. The concentrations of copper detected in the SMA samples are less than the developed site UTL but are slightly above the undeveloped UTL, which is consistent with the land use in the S-SMA-1.1 drainage area.	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, and PCBs	No. Copper is not known to be associated with industrial materials historically managed at the Site. Copper was detected above BVs in 2 of 6 shallow samples (i.e., less than 3 ft bgs) at a maximum concentration 2.8 times the soil BV but was not statistically different from background.	Yes; 5.2-5.8 µg/L Cu detected.	SWMU 03-029 is included in the supplemental investigation report for the Upper Sandia Canyon Aggregate Area, submitted to NMED under the Consent Order on August 27, 2013, and is recommended for corrective action complete without controls in that report. SWMU 03 029 will be eligible for a CoC upon approval of the report by NMED.

SMA	Site ID	Site Description	AU	Site Monitoring Requirements[1]	Is Site a Potential Source of Copper?	Dissolved Copper (Cu) TAL Exceedance	IP Status[2,3] (as of 12/31/2012)
S-SMA-2	03-012(b)	SWMU 03-012(b) is soil contamination associated with operational releases from the TA-03 power plant, building 03-22, and associated cooling towers, including cooling tower drift. Potential contaminants associated with industrial materials historically managed at this Site are chromium and PCBs. The original IP Site narrative for Site 03-045(b) stated that Sites 03-012(b) and 03-045(b) are the same. The August 2013 supplemental investigation report for Upper Sandia Canyon Aggregate Area treats them separately: Site 03-012(b) addresses potential soil contamination associated with the historical operation of the cooling towers, and Site 03-045(b) is the outfall itself. The SMA receives run-on primarily from developed areas in TA-03. The SMA result for copper is less than the backgrounds for developed sites.	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, and PCBs	No. Copper is not known to be associated with industrial materials historically managed at this Site. Copper was detected above the soil BV in shallow (i.e., less than 3 ft bgs) soil samples collected before construction activities in 2002 and 2003. Copper was detected above BV in 2 of 42 shallow samples at a maximum concentration 1.8 times the soil BV.	Yes;	In corrective action; a request for alternative compliance that included this site was submitted to EPA on [date] and EPA's response was issued on March 27, 2014. EPA established a new compliance date of 10/31/2015 for this site. The Consent Order Phase I investigation has been completed for SWMUs 03-012(b), 03-045(b), and 03 045(c), and these Sites were included in the August 2013 supplemental investigation report for Upper Sandia Canyon Aggregate Area. SWMU 03-012(b) was recommended for corrective action complete without controls. A force majeure request was submitted to EPA on September 23, 2013, based upon the anticipated issuance by the NMED of a CoC without controls. This Site was also included in the alternative compliance request for S-SMA-2 that was submitted to EPA in October 2013.
	03-45(b)	SWMU 03-045(b) is the NPDES-permitted outfall (Outfall 001) that currently receives treated sanitary effluent from the TA-46 Sanitary Wastewater Systems Consolidation (SWSC) Plant and SERF as well as occasional discharges of power plant cooling tower blowdown. The original IP Site narrative for Site 03-045(b) stated that Sites 03-012(b) and 03-045(b) are the same. The August 2013 supplemental investigation report for Upper Sandia Canyon Aggregate Area treats them separately: Site 03-012(b) addresses potential soil contamination associated with the historical operation of the cooling towers, and Site 03-045(b) is the outfall itself. Phase I Consent Order Phase investigations are complete for SWMU 03-045(b), and the Site was included in the August 2013 supplemental investigation report for Upper Sandia Canyon Aggregate Area. SWMU 03-045(b) was recommended for additional extent sampling.The SMA receives run-on primarily from developed areas in TA-03. The SMA result for copper is less than the backgrounds for developed sites.	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, and PCBs	No. Copper is not known to be associated with industrial materials historically managed at this Site. Copper was not detected above soil BV in shallow (i.e., less than 3 ft bgs) 2009 Consent Order samples.	Yes;	In corrective action; a request for alternative compliance that included this site was submitted to EPA on [date] and EPA's response was issued on March 27, 2014.EPA stated in its findings and determinations that non-storm water discharges from an active industrial NPDES permit cannot be considered point source discharges under the IP. As a result, the Permittees proposed to delete this site from the IP in its March 27, 2014 renewal application.
	03-045(c)	SWMU 03-045(c) is an NPDES-permitted outfall (EPA 03A027) that previously received effluent from a cooling tower (structure 03-285), which served the generators powering a Laboratory computer system and may have historically received chromate-treated water. Outfall 03A027 is currently permitted for the discharge of cooling tower blowdown water and other wastewater from structures 03-285 and 03-2327. The Consent Order Phase I investigation has been completed for SWMUs 03-012(b), 03-045(b), and 03 045(c), and these Sites were included in the August 2013 supplemental investigation report for Upper Sandia Canyon Aggregate Area. SWMU 03-045(c) was recommended for additional sampling to define extent. The SMA receives run-on primarily from developed areas in TA-03. The SMA result for copper is less than the backgrounds for developed sites.	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, and PCBs	No. Copper is not known to be associated with industrial materials historically managed at this Site. Copper was not detected above soil BV in shallow (i.e., less than 3 ft bgs) Consent Order soil samples.	Yes;	In corrective action; a request for alternative compliance that included this site was submitted to EPA on [date] and EPA's response was issued on March 27, 2014. EPA stated in its findings and determinations that non-storm water discharges from an active industrial NPDES permit cannot be considered point source discharges under the IP. As a result, the Permittees proposed to delete this site from the IP in its March 27, 2014 renewal application.

SMA	Site ID	Site Description	AU	Site Monitoring Requirements1	Is Site a Potential	SMA	Site ID
	03-056(c)	SWMU 03-056(c) is a former outdoor storage area located at TA-03 on the north side of a utilities shop, building 03-0223. The outdoor storage area was used to store electrical equipment, capacitors, and transformers with PCB-containing dielectric fluids. Waste solvents used for cleaning electrical equipment were also stored at this location. Two actions have been performed at SWMU 03-056(c) to remove historical PCB contamination. NMED issued a CoC with controls for SWMU 03-056(c) on February 18, 2011. In its certificate, NMED stated that the nature and extent of contamination were defined, confirmatory sample results indicated the Site met the EPA's PCB cleanup criterion, and the Site poses no potential unacceptable human health and ecological risks from PCBs or VOCs. The required controls were to institute and maintain a control on the Site by monitoring storm water discharge for potential off-site transport of residual PCB contamination. The basis for the required control under the Consent Order was the possibility that storm water discharge may mobilize residual contamination from the Site. NMED also indicated the storm water monitoring was currently implemented pursuant to the Individual Permit. and organic solvents. The SMA receives run-on primarily from developed areas in TA-03. The SMA result for copper is less than the backgrounds for developed sites.	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, and PCBs	No. Copper is not known to be associated with industrial materials historically managed at this Site. Copper was detected above the soil BV in shallow VCA confirmation samples. Copper was detected above BV in 2 of 21 shallow soil and tuff samples at a maximum concentration 1.02 times the soil BV, which is less than the maximum background concentration.	Yes;	In corrective action; a request for alternative compliance that included this site was submitted to EPA on [date] and EPA's response was issued on March 27, 2014. EPA stated in its findings and determinations that corrective action has been completed at this site because of the CoC issued by NMED.
S-SMA-2.01	AOC 03-052(b)	AOC 03-052(b) consists of five storm water collection areas near the Sigma Building (03-66). Potential contaminants associated with industrial materials historically managed at this site would likely be those associated with upstream sites that are the source of the storm water runoff received at AOC 03-052(b).	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, and PCBs	No. Copper is not known to be associated with industrial materials historically managed at this Site.	Yes; 10.7-10.9 µg/L Cu detected.	Recommended for corrective action complete under the Consent Order.
S-SMA-2.8	AOC 03-014(c2)	AOC 03-014(c2) is the inactive overflow outfall that previously received treated effluent from the former TA-03 wastewater treatment plant (WWTP) from 1975 to 1985, when the WWTP chlorination system[SWMU 03-014(j)] was constructed. Following the construction of the chlorination system, the outfall was rerouted underground where the final effluent discharged freely into Sandia Canyon. This outfall was abandoned in 1988 or 1989, when the WWTP effluent was routed to a new outfall, AOC 03-014(b2).	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, PCBs, and SVOCs	No. Copper is not known to be associated with industrial materials historically managed at this Site.	No.	No IP sample collected. Proposed additional sampling for PCBs under the Consent Order to define the vertical extent of Aroclor-1254 and Aroclor-1260 at one sampling location. AOC 03-014(c2) will likely be recommended for corrective action upon completion of the Phase II sampling recommended in the Upper Sandia Canyon Aggregate Area investigation report.
S-SMA-3.51	03-009(i)	SWMU 03-009(i) is an inactive surface disposal site located east of the liquid and compressed-gas facility (building 03-0170). This site consists primarily of clean fill from TA-03 construction sites with construction debris, including crushed tuff, pieces of concrete, and asphalt mixed in with some of the fill material.	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, PCBs, and SVOCs	No. Copper is not known to be associated with industrial materials historically managed at this Site.	No.	No IP sample collected. SWMU 03-009(i) is included in the supplemental investigation report for the Upper Sandia Canyon Aggregate Area, submitted to NMED under the Consent Order on August 27, 2013; the Site meets residential risk levels and is recommended for corrective action complete in that report. SWMU 03 009(i) will be eligible for a CoC upon approval of the report by NMED.
S-SMA-3.52	03-021	SWMU 03-021 is an outfall and associated daylight channel located near the liquid and compressed gas facility (building 03-0170). The outfall is a formerly NPDES-permitted outfall (EPA 04A094) and was removed from the 1997 permit. From 1964 to 1976, the outfall discharged caustic wash and rinse water from compressed-gas-cylinder cleaning operations. The end of the outfall pipe discharged into a surface ditch that continued about 180 ft to the main drainage ditch. This outfall was not used after 1976.The outfall was buried when 5 to 10 ft of fill material was placed over the former outfall area and graded during site-preparation activities.	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, PCBs, and SVOCs	No. Copper is not known to be associated with industrial materials historically managed at this Site.	No.	No IP sample collected. SWMU 03-021 is included in the supplemental investigation report for the Upper Sandia Canyon Aggregate Area, submitted to NMED under the Consent Order on August 27, 2013; the Site meets residential risk levels and is recommended for corrective action complete in the report. SWMU 03-021 will be eligible for a CoC upon approval of the report by NMED.

SMA	Site ID	Site Description	AU	Site Monitoring Requirements1	Is Site a Potential	SMA	Site ID
S-SMA-3.53	AOC 03-014(b2)	AOC 03-014(b2) is a former NPDES-permitted outfall (EPA SSSO1S) for the former TA-03 WWTP that received treated effluent from the SWSC plant at TA-46 from 1992 to 1998 when the effluent was switched to the outfall at the power plant, building 03-0022. From 1989 to 1993, radioactive constituents were reported over the detection limits. Potential contaminants associated with industrial materials historically managed at this Site are various organic chemicals, metals, and radionuclides present at low concentrations in the effluent from the former TA-03 WWTP. The SMA sampler is located on Bandelier Tuff and receives runoff from undeveloped and developed areas. The concentration of copper detected in the SMA sample is greater than the undeveloped area UTL and less than the developed site UTL.	NM-9000.A_047	Gross alpha, Ra-226, Ra-228, cyanide, metals, PCBs, and SVOCs	No. Copper is not known to be associated with industrial materials historically managed at the Site and was not detected above BVs in Consent Order samples collected at the Site.	Yes; 9.6 µg/L Cu detected.	No IP sample collected. AOC 03-014(b2) is included in the Supplemental Investigation Report for the Upper Sandia Canyon Aggregate Area submitted to NMED under the Consent Order on August 27, 2013, and is recommended for corrective action complete without controls in that report. AOC 03 014(b2) will be eligible for a CoC upon approval of the report by NMED.
S-SMA-3.6	60-007(b)	SWMU 60-007(b) is a storm drainage ditch at TA-60 that starts near the motor pool building (60-0001) and extends to the bottom of Sandia Canyon, including contribution from two parking lots located east of building 60-0001. Other former sources of potential contamination to the ditch are a steam-cleaning pad, a used-oil storage tank, and an oil/water separator. In addition, equipment that used PCB-containing oil was stored on an asphalt area east of building 60-0001. Potential contaminants associated with industrial materials historically managed at this Site are petroleum products and PCBs. The SMA sampler primarily receives runoff from developed areas (buildings, parking lots, roads) although some of the SMA drainage area is vegetated. The concentrations of copper detected in the SMA samples are less than the developed site UTLs, which is consistent with what is expected for runoff from a developed area, such as the S SMA-3.6 drainage area. These results, along with the low magnitude and frequency of copper detections in Consent Order samples, are consistent with the Site not being the source of TAL exceedances. In addition, the concentrations of copper in baseline monitoring samples are similar to those in enhanced control confirmation samples.	NM-9000.A_047	Gross Alpha, Ra-226, Ra-228, Cyanide, Metals, PCBs, high explosives	No. Copper is not known to be associated with industrial materials historically managed at the Site. Copper was detected above BVs in 2 of 20 shallow samples (i.e., less than 3 ft bgs) with a maximum concentration 2.6 times the soil BV, but the copper results were not statistically different than background.	Yes.	SWMU 60-007(b) is included in the supplemental investigation report for the Upper Sandia Canyon Aggregate Area submitted to NMED under the Consent Order on August 27, 2013, and the report recommends corrective action complete without controls for the Site. SWMU 60 007(b) will be eligible for a CoC upon NMED's approval of the report.

[1] Source: Appendix B, NPDES Permit No. NM030759, November 2010.

[2] Source: 2012 Update to the Site Discharge Pollution Prevention Plan, Revision 1, Los Alamos National Laboratory NPDES Permit No. NM0030759, May 1, 2013, Sandia/Mortandad Watershed Receiving Waters: Sandia Canyon, Cañada del Buey, Mortandad Canyon, and Ten Site Canyon, Volume 2.

[3] Upper Sandia Canyon Aggregate Supplemental Investigation Report, August 2013.

Table 4
Multi-Sector General Permit Sites in Sandia Canyon Assessment Unit NM-9000.A_47

Facility Name	Outfall/Station #	Sector	Sector Specific Benchmarks[1] for Copper	LANL Specific Backgound (ug/L)	Results of Copper (ug/L) Monitoring[2,3]	No. of Samples	Status of Current Monitoring
TA-3-38 Metals Fab Shop	3-MFS-1/03-0038W	AA	No	133	42.7	1	monitoring discontinued in 1st quarter 2011 - constituent below permit defined levels
TA-3-22 Power and Steam Plant West	3-PSP-8/03-0022N	O	No	133	53.3	1	monitoring discontinued in 3rd quarter 2011 - constituent below permit defined levels
	3-PSP-5/E121.9	O	No	133	62.4	1	monitoring discontinued in 1st quarter 2011 - constituent below permit defined levels
	3-PSP-1/03-0022S	O	No	133	36.4 - 181	2	monitoring discontinued in 1st quarter 2012 - constituent below permit defined levels
TA-3-66 Sigma Complex	3-Sigma-6/E122.3	F	Yes	133	14 - 28.2	7	monitoring discontinued in 4th quarter 2010 - constituent below permit defined levels
	3-Sigma-8/03-0141E	F	Yes	133	2.71 - 9.71	4	monitoring discontinued in 4th quarter 2012 - constituent below permit defined levels
TA-60-1 Heavy Equipment Yard	60-HEY-2/60-0001	P	No	133	28.4	1	monitoring discontinued in 3rd quarter 2011 - constituent below permit defined levels
TA-60-2 Warehouse	60-WH-1/60-0002E	P	No	133	70.4	1	monitoring discontinued in 1st quarter 2011 - constituent below permit defined levels
TA-60 - Roads and Grounds West	60-RG-3/123.4	P	No	133	11.4	1	monitoring discontinued in 2nd quarter 2011 - constituent below permit defined levels
	60-RG-8/60-00RGE	P	No	133	66.6	1	monitoring discontinued in 3rd quarter 2011 - constituent below permit defined levels
TA-60 Roads & Grounds Clean Fill Yard	60-RG-10 / 60RGDCFYE	P	No	133	6.39	1	monitoring discontinued in 3rd quarter 2013 - constituent below permit defined levels
TA-60 Materials Recycling Facility	60-MRF-1/E122.35	N	Yes	133	21.3 - 569	15	monitoring discontinued in 3rd quarter 2012 - constituent below permit defined levels

1. Benchmark Levels 15.6 ug/l
2. Monitoring During Permit Period April 2009 – November 2013
3. Total Copper

1.3.1.4 Gages Used in Evaluation of Upper Sandia Canyon AU

The Laboratory's environmental surveillance storm water monitoring gages E121, E123 and Middle Sandia at WP Terminus (SCS-2) will serve as the location for determining reduction in copper concentration and attainment of water-quality targets for the 4b Demonstration. These gages are located in the Upper Sandia Canyon AU as indicated below and are shown on the map in Appendix 1.

1. Gaging Station E121 – South Fork of Sandia Canyon near power plan. E121 is located west of wetland and down gradient of NPDES Outfall 001.

2. Gaging Station E123 – Sandia Canyon just east of wetland. The location selected to monitor persistent surface flows exiting the wetland.

3. Surface Water Sampling Station SCS-2 – Middle Sandia Canyon. Location selected to monitor surface water near the eastern terminus of persistent base flow.

1.3.2 Non-point Source Locations and Potential Magnitudes

The watershed discharging to upper Sandia Canyon is comprised of approximately 150 acres of LANL property and 29 acres of area under the control of Los Alamos County. The majority of the LANL area is impervious surfaces located within an urban environment consisting of buildings, parking lots, and light industrial facilities. Remaining areas are comprised of native perennial vegetation or landscaping. The majority of the watershed area within LANL is located west of the head of Sandia Canyon. Runoff within this area is primarily managed through LANL's storm drain infrastructure system and discharged at specific locations near the head of the canyon. Remaining areas discharge to surface conveyances that flow directly to the canyon.

Within this 150 acre area are seven NPDES MSGP regulated facilities with a combined total area of 35 acres. These facilities manage storm water runoff and potential pollutants in accordance with the MSGP requirements, as described in section 1.3.1.3. Also within the 150 acres are nine SWMUs, which are authorized to discharge under the IP, and comprise less than an acre. However, the drainage to these SWMUs comprises discharge to the SMA from 100 acres of developed locations.

1.3.2.1 Non-point Source from Urban and Developed Areas within the Laboratory

The concentration of copper in surface water is influenced by the nature and extent and distribution in canyon sediments. Spatial variation in sediments indicates the bulk of the copper inventory reside in the Sandia Wetland, located in the AU (7). Metals, including copper, are common in urban and developed storm water runoff. The sources of these metals are numerous and include, but are not limited to, automobile tires and brakes, roofing and down-spout materials, metal culverts, and chain-link fencing. Vehicle brake emissions are one of the most significant sources of copper in an urban or developed environment (8).

Storm water samples were collected from 2009 to 2012 at developed urban monitoring locations throughout the Laboratory and within the Los Alamos County townsite to determine potential nonpoint source urban/developed runoff for metals. These results are summarized in a recent DOE/LANS publication analyzing background and baseline metals in northern New Mexico, entitled "Background Metals Concentrations and Radioactivity in Storm Water on the Pajarito Plateau, Northern New Mexico" (the Metals Background Report) (9). This potential non-point source is referred to as "baseline" in the Metals Background Report.

The principal objectives of the study were to (1) determine background concentrations in undeveloped Reference watersheds and Western Boundary locations, and (2) determine the baseline/non-point source concentrations of metals and radioactivity in urban runoff from the Los Alamos County townsite and developed landscapes within the Laboratory.

Estimates of the upper limit of baseline conditions, intended for use in determining if runoff from these non-point source conditions is exceeding associated water quality criteria, were calculated based on upper tolerance limits (UTLs).

The copper baseline UTL for storm water runoff from combined urban runoff from the Los Alamos County townsite and developed landscapes within the Laboratory on the Pajarito Plateau is 32.3 µg/L. The UTL for storm water runoff from developed landscapes within the Laboratory is 34.19 ug/l.

In the Alternative Compliance Request for S-SMA-0.25 (8), the Laboratory determined that site-specific storm water run-on samples collected within the S-SMA-0.25, but upgradient of the IP-regulated SWMUs, contained copper at concentrations ranging from 4.05 µg/L to 6.75 µg/L, which is greater than the IP TAL of 4.3 µg/L (4). Similarly, the Laboratory determined that site-specific storm water run-on samples collected within the S-SMA-2.0, but upgradient of the IP-regulated SWMUs, contained copper at concentrations ranging from 4.78 µg/L to 21.3 µg/L, which are also greater than the IP TAL of 4.3 µg/L. These data, combined with site history and soil data collected under the Consent Order, nonpoint source storm water runoff from developed areas is clearly contributing to the TAL exceedences. The copper baseline from urban and developed Laboratory sites and measured concentrations in storm water run-on at two IP monitoring locations are presented in Table 5a.

Table 5a
Baseline Pajarito Plateau Storm Water Dissolved Copper Concentrations (µg/L)

Urban and Laboratory developed site Runoff Baseline Values[a]	Laboratory Developed Site Runoff Baseline Values	Run-on to S-SMA-0.25[b]	Run-on to S-SMA-2[b]
32.3	34.19	4.05–6.75	4.78–21.3

[a] Urban Runoff BVs—Urban runoff in the vicinity of Los Alamos townsite and Laboratory property.

[b] Data from Alternative Compliance Request for S-SMA-0.25 and S-SMA-2 (4).

The Metals Background Report was produced by LANL and not written to meet any specific regulatory requirements. Consequently it has never been formally reviewed or accepted by any regulatory agencies, nor is that expected. LANL intends to collect more data in the 2014 field season to support a revision to this report.

It is important to understand that the site-specific background and urban/developed areas baseline values for copper in the Metals Background Report are not the primary information source used to make the determination whether or not copper was routinely and systematically released at a Site from historical activities (i.e.: a determination if copper is a significant industrial material at a Site). Consent Order soil data and Site history are the primary information sources used to make this determination. If the review of soil data and Site history demonstrate that copper was not released at the Site, the Metals Background Report is used to as a tool to help determine where the TAL exceedance could be coming from. If the review of soil data indicates that copper was released from historical site activities but the TAL exceedance is higher than would be predicted based on the soil concentrations, the Background Report

is used to assist in the determination of other non-Site related potential contributors to the TAL exceedance.

There is no formal agreement that the site-specific background and urban/developed areas baseline values are acceptable and representative. LANL has used these baseline values in site evaluations and for making corrective action determinations in correspondence with EPA. An updated background report will be issued in 2014 and NMED has been made aware of our intent to update the report and has agreed to participate in grouping of monitoring locations and draft reviews.

It should be noted that the selection of the run-on sample locations at SMA-0.25 and SMA-2 were not intended to be up gradient of all potential sources but to specifically understand the storm water flowing onto the regulated Sites. The locations were chosen to be representative of run-on to the Sites specifically, not of run-on to the entire facility. In addition, it is not always possible to capture paired run-on and run-off samples given the nature of the topography and the localized, intense storms seen in the area.

The source of the high dissolved copper concentrations found in the urban/developed area storm water include automobile brake pads, architectural copper, copper pesticides, vehicle washing, copper cladding on buildings, roofs, pipes, down spouts, printing, cooling towers, and vehicle services. The dominant source of copper in urban runoff is brake pad wear.

1.3.2.2 Non-point Source from Natural Background

Naturally occurring sources of copper are summarized in the Metals Background Report (9). Background storm water samples were derived from two primary groups of locations: tributaries that enter the Laboratory's western (upstream) boundary and tributaries in a remote area north of the community of Los Alamos or Reference Area. The results from Reference Area stations reflect background runoff conditions from landscapes at Sandia Canyon with surficial geological materials derived from Bandelier Tuff, Puye Formation, and the Tschicoma Formation (9). The results from Western Boundary stations reflect background runoff conditions from landscapes with surficial geological materials derived from Bandelier Tuff and diorite-rich Tschicoma Formation (9). The copper background values from undeveloped areas are presented in Table 5b.

Table 5b
Background Pajarito Plateau Storm Water Dissolved Copper Concentrations (µg/L)

Reference Area[a] Background Values	Western Boundary[b] Background Values
3.43	5.7

Note: All the Reference and Western Boundary station locations were upstream of and distant from Laboratory liquid discharges.

[a] Reference Area—Ephemeral tributaries to the Rio Grande north of the Laboratory and urban Los Alamos County. The northernmost tributary sampling stations is located in middle portion of the Pajarito Plateau. Surface water monitored at the Reference sites is mostly generated as storm water from local storms affecting the northern portion of the Pajarito Plateau.

[b] Western Boundary—Ephemeral, intermittent, and perennial tributaries to the Rio Grande to the west and upstream of the Laboratory and urban Los Alamos County.

2. DESCRIPTION OF POLLUTION CONTROLS AND HOW THEY WILL ACHIEVE WATER-QUALITY STANDARDS

2.1 Water Quality Targets

The demonstration should identify a numeric water quality target(s). That is the chemical causing the impairment and the numeric criteria for that chemical in the water quality standard (i.e., the chemical causing the impairment and the water quality standard). Express the relationship between any necessary reduction of the pollutant of concern and the attainment of the numeric water quality target.

2.1.1 Numeric Targets

The numeric water quality target for dissolved copper is the hardness-dependent numeric criteria as described in NM's water quality standards at 20.6.4.900 Subsection I 1 and 2 (2). Because these are hardness-dependent criteria, the exact water quality target value depends upon concurrently-measured hardness. For the purpose of this demonstration, a representative hardness value of 75 mg/l was used.

A load-duration curve was developed for E-123 that provides a framework to identify target daily loads over the full range of flow conditions (Figure 2). By displaying the instantaneous loads calculated from ambient water-quality data and the average flow on the date of the sample, a pattern develops that describes the characteristics of the water-quality impairment. Loads that plot above the curve indicate an exceedance of the water-quality criterion (dissolved copper in this case), while those that fall below the load-duration curve show compliance.

The water-quality criteria for dissolved copper were exceeded in two instances at higher flow rates and not at lower flow rates. This demonstrates that the exceedences for copper are storm water-driven.

There is not enough flow data available to construct a flow duration curve for the most downstream gage in the AU reach, SCS-2 Middle Sandia at WP Terminus. No exceedances of the dissolved copper water-quality criteria were in the 2008-2013 baseflow dataset for this station.

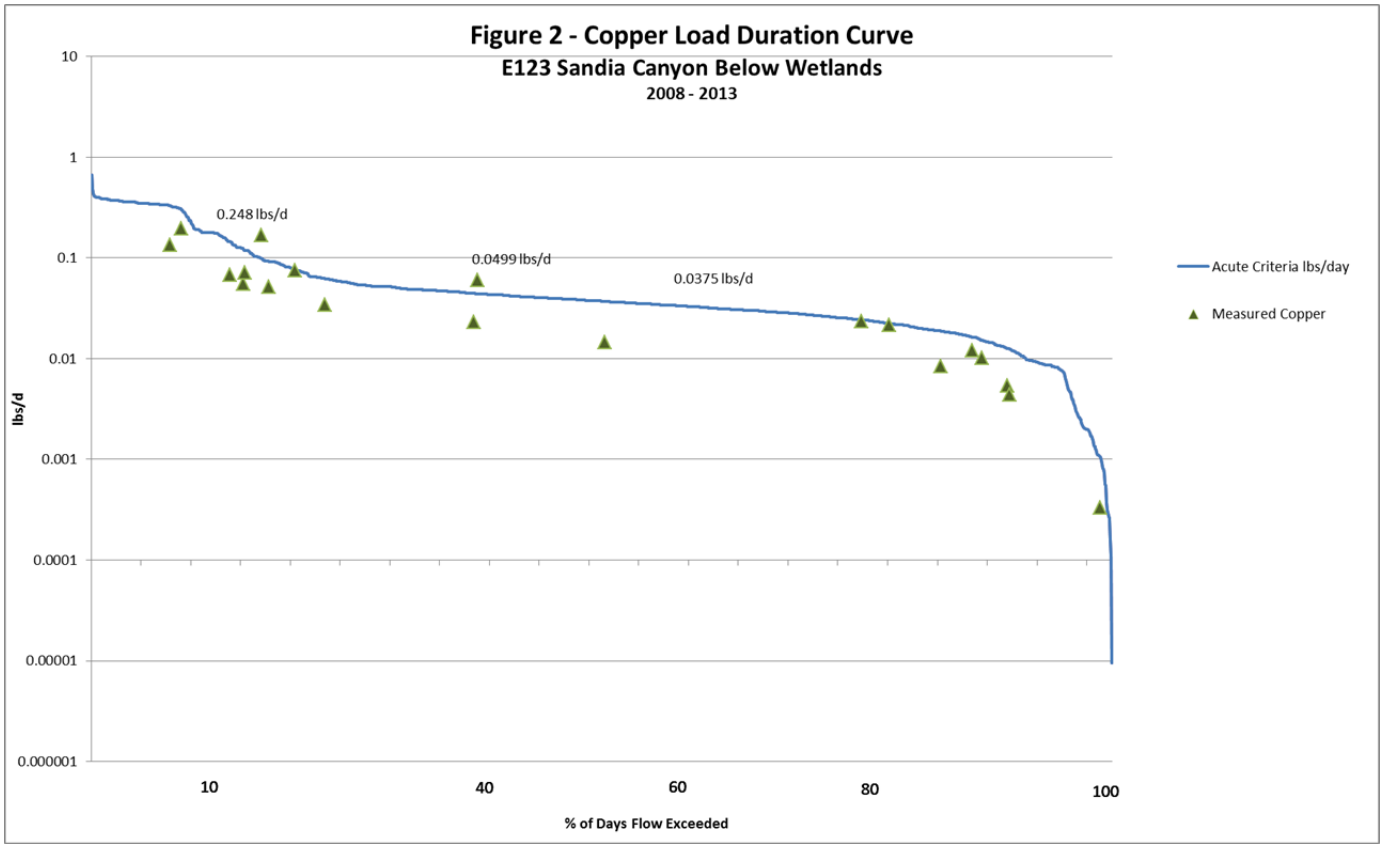

Figure 2 E-123 (Sandia below Wetlands) load duration curve for copper

2.1.2 Current Conditions

NMED used water-quality data from gages E-121, E-121.9, E-123, and SCS-2 to develop the draft 2014-2016 Integrated Report (1). The AU was found as not supporting coldwater aquatic life, and dissolved copper was determined to be a probable cause of the impairment based on available data from these gages. Data from these gages were compiled for the period from 2008 to 2013 and are summarized in Table 6. To prepare Figures 3 through 5, hardness-acute aquatic life criteria were calculated using the hardness-dependent equations in 20.6.4.900 NMAC Subsection I (2). The acute aquatic life criteria were then compared with the measured valued for copper. All available data were used to assess the copper criteria regardless of hydrologic condition. The dissolved copper acute criteria targets were exceeded on seven occasions between 2008 and 2013. All the exceedances of the applicable acute criteria occurred during storm water flow events. The acute water-quality criteria for copper were exceeded at gages E121 and E-123. The criteria were not exceeded at gages E-121.9 and SCS-2.

Table 6
Copper Monitoring Data for Watershed Based Gages Period 2008–2013

Monitoring Location	Min (µg/L)	Max (µg/L)	Mean (µg/L)	Median (µg/L)	No. of Samples	Ratio of Storm water Samples	No. of Acute WQC Exceedances
E121.9 Sandia Canyon East of Power Plant	—*	4.3	—	—	1	0/1	0
E121 (S-SMA-2) Right Fork at Power Plant	3.23	20.4	7.1	5.7	14	4/14	3
E123 - Sandia Below Wetland	3.16	17.5	6.4	5.3	25	12/25	5
Middle Sandia at WP Terminus (SCS-2)	3.1	6.5, <10	4.6	3.5	10	0/10	0

*Only one data point available.

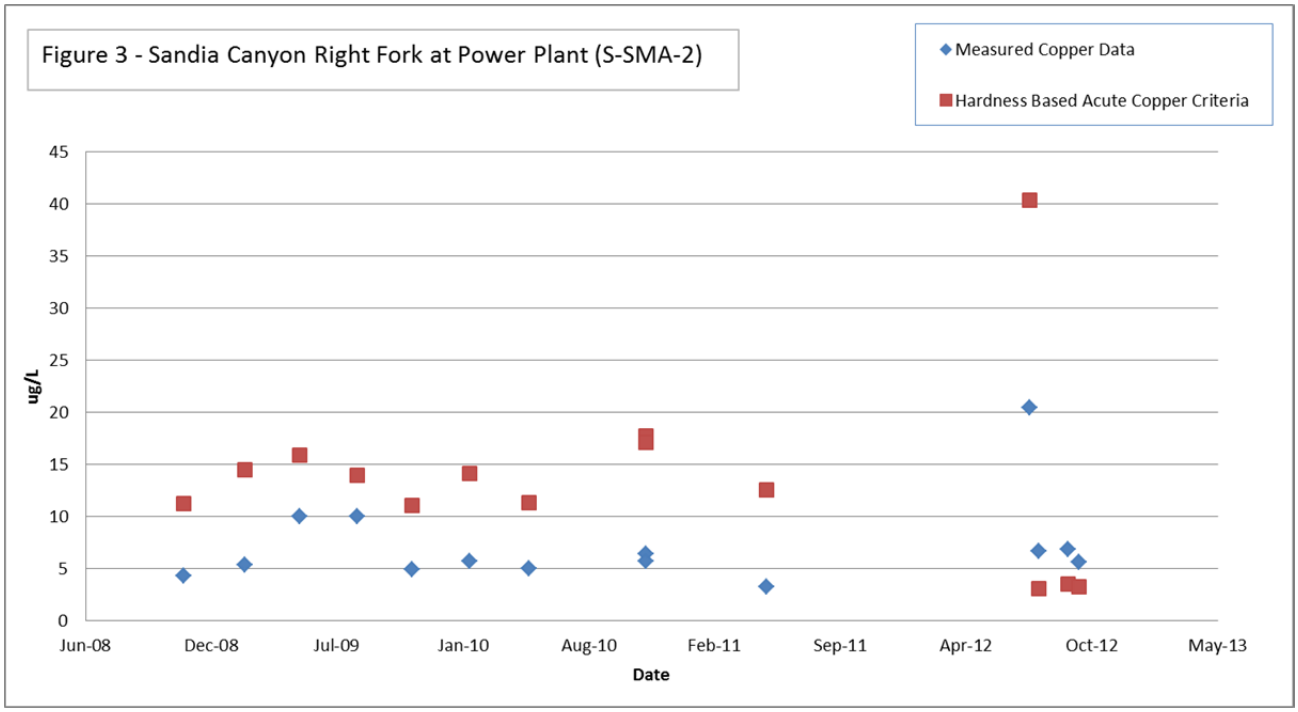

Figure 3 Measured copper versus hardness-based acute copper criteria at E-121 (Sandia Canyon Right Fork at Power Plant [S-SMA-2])

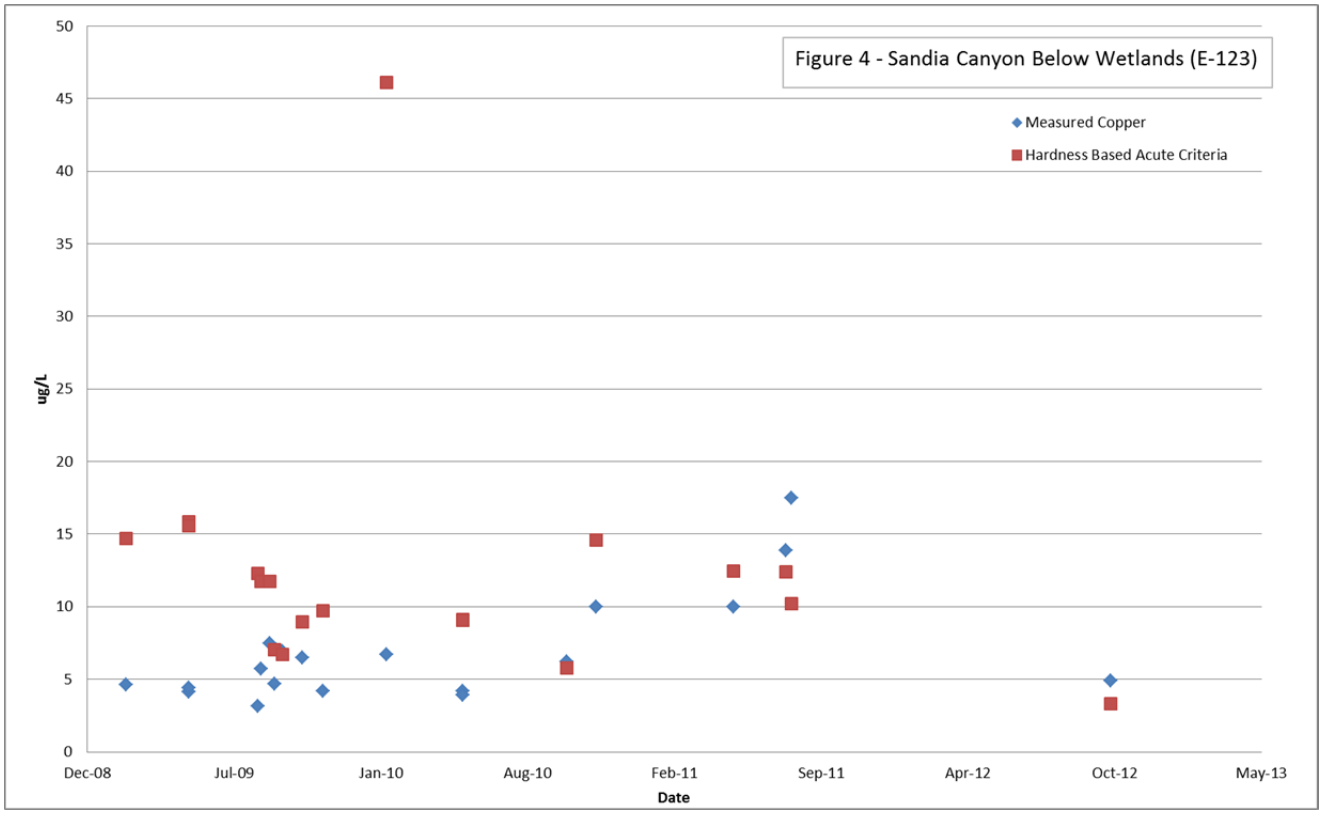

Figure 4 **Measured copper versus hardness-based acute copper criteria at E123 (Sandia below Wetlands)**

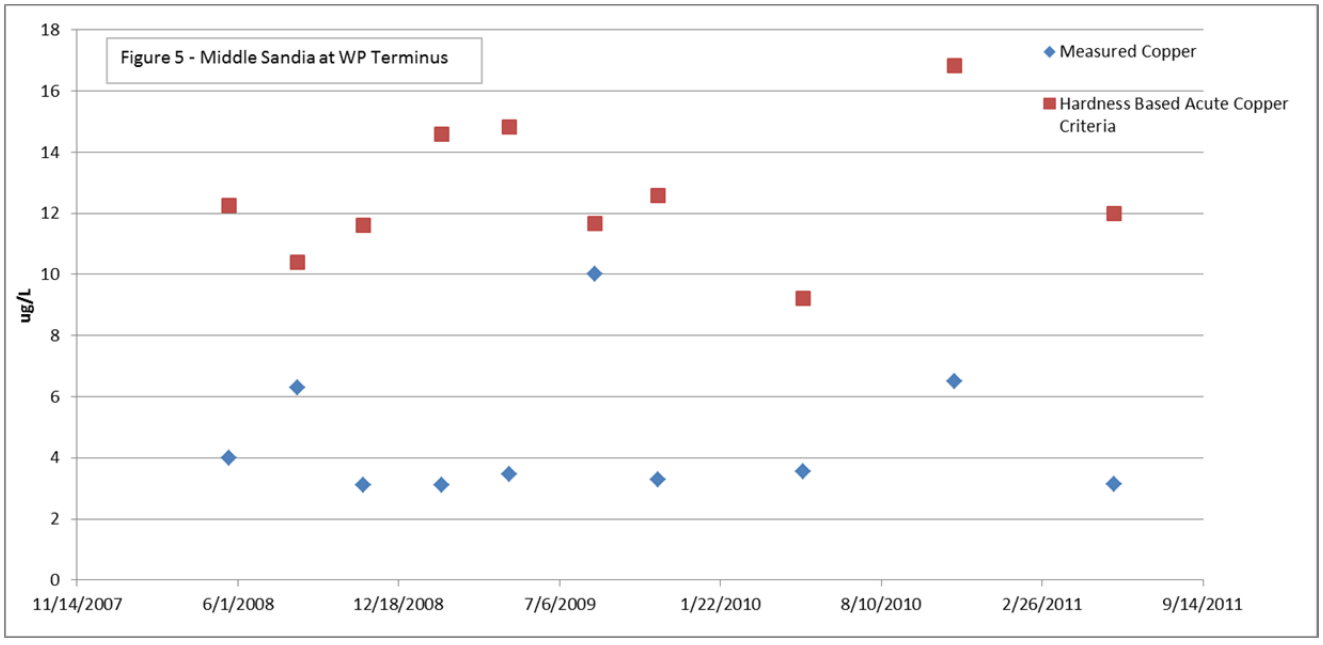

Figure 5 **Measured copper versus hardness-based acute copper criteria at SCS-2 (Middle Sandia at WP Terminus)**

2.1.3 Necessary Reduction to Meet Target

The Laboratory's environmental surveillance storm water monitoring gages E121, E123 and Middle Sandia at WP Terminus (SCS-2) will serve as the location for determining reduction in copper concentration and attainment of water-quality targets for the 4b Demonstration. The locations of the sampling points are shown on the map in Appendix 1.

The target loading capacity is the greatest amount of pollutant loading that a water can receive without violating the water quality standard. The load duration curve in Figure 2, generated from flows at E-123, provides the target loading capacity across a full range of stream flow conditions. The target values for flows in the higher ranges (flows occurring ≤ 40% of time) are provided in Table 7. Exceedances of the water quality criteria correspond to high flow events and generally reflect probable non-point source contributions. Consequently, management of the load, generated during storm events, is the key to attainment of the WQS.

The target loads in Table 7 are derived from (WLA + LA + MOS = Target Load):

LA – the portion of the load capacity attributed from non-point sources (urban/developed and natural background).

WLA – the portion of the loading capacity attributed from point sources (IPSP, MSGP and IP).

MOS - margin of safety (MOS) of 10% is used to account for uncertainties in load allocations and provide additional time to further develop and define our knowledge of sources originating from natural back ground and urban developed areas.

The copper values used to determine outfall loading rates were obtained from Form 2C in the reapplication for IPSP Permit # NM0028355. The flow values were developed from the 2012 monthly averages reported in discharge monitoring reports to EPA Region VI.

Table 7 Targert Loads for Dissolved Copper in Upper Sandia AU (E-123)

			High Flow (0-10%)[1]	**Mid-Range Flows (10-40%)[1]**	**Low Flow**
Target Loads	**2012 Average Flow[2](mgd)**	**Copper[3] (ug/L)**	**0.248 lbs/day**	**0.0499 lbs/day**	**-**
Outfall[1] 001	0.268	2.6	0.0058	0.0058	-
Outfall[1] 027	0.059	2.2	0.00108	0.001080	-
Outfall[1] 199	0.041	13.2	0.0045	0.0045	-
S-SMA	-	-	0	0	-
MSGP	-	-	0	0	-
Total Waste Load Allocation (WLA)	-	-	0.0113	0.0113	-
Load Allocation (LA)	-	-	0.212	0.0336	
Margin of Safety[5] (MOS)	-	-	0.0248	0.00499	-
Target Loads	-	-	**0.248**	**0.0499**	**-**

1. Outfall load is calculated based on flow x copper value x conversion factor 8.34
    a. Outfall 001 - 0.0026 mg/L x 0.268 mgd x 8.34
    b. Outfall 027 - 0.0022 mg/L x 0.059 mgd x 8.34
    c. Outfall 199 – 0.013 mg/L x 0.041 mgd x 8.34
2. 2012 Average Outfall Flow

2012		001	03A027	03A199
Jan	Total (gal)	10,063,100	1,594,600	934,100
Feb	Total (gal)	9,652,800	1,520,500	953,600
Mar	Total (gal)	9,787,700	1,654,800	1,151,400
Apr	Total (gal)	7,943,600	1,762,500	1,203,300
May	Total (gal)	6,817,600	1,842,500	1,363,600
Jun	Total (gal)	6,486,200	2,015,600	1,699,000
Jul	Total (gal)	7,466,700	2,083,600	1,624,700
Aug	Total (gal)	7,492,900	2,089,500	1,567,900
Sep	Total (gal)	7,006,400	1,954,000	1,332,700
Oct	Total (gal)	8,469,700	1,932,300	1,266,500
Nov	Total (gal)	8,687,600	1,666,900	998,200
Dec	Total (gal)	8,007,700	1,511,100	972,900
	Total Gal	97,882,000	21,627,900	15,067,900
	Mgal	97.882	21.6279	15.0679
	mgd	0.268	0.059	0.041

3. NPDES NM0028355 Permit Renewal Application Form Copper values used on Form 2C from application renewal

Location ID	Parameter Name	Report Result	Report Units	Detected	Sample Matrix	Sample Purpose	Filtered
NPDES Outfall 01A001	Copper	2.6	ug/L	Y	W	REG	N
NPDES Outfall 03A027	Copper	2.2	ug/L	N	W	REG	N
NPDES Outfall 03A199	Copper	13.2	ug/L	Y	W	REG	N

4. No TMDL calculations for lower flow because there were no WQS exceedances
5. 10% MOS

The largest contribution to the target load is from non-point sources. The baseline value for copper originating from developed sites at the Laboratory is 34.19 ug/l (Table 5a). Elevated levels of copper are known to be associated with sediments which are positively related to the amount of storm water draining from impervious surfaces to Sandia Canyon. Background levels of copper from natural sources is 3.14 ug/l (Table 5b). In Figure 6 below, there appears to be a relationship between total suspended sediments (TSS) and dissolved copper concentrations. TSS was not always available with the corresponding dissolved copper data. Additional data will be collected and TSS sampling is included in the monitoring plan. It is anticipated that monitoring will be conducted at multiple locations within the developed areas upstream from Sandia Canyon AU to collected first flush storm event samples. Results from these samples will be compared to baseflow and storm event samples from downstream gages to evaluate TSS-dissolved copper correlations. The factors that govern the partition between dissolution,

precipitation, adsorption, and redox processes, on the formation of the dissolved copper fraction in rain water and storm water, have not been specifically investigated at the Laboratory. Consequently, sampling in the early stages of a storm event will further our understanding of the factors that impact dissolved copper concentrations.

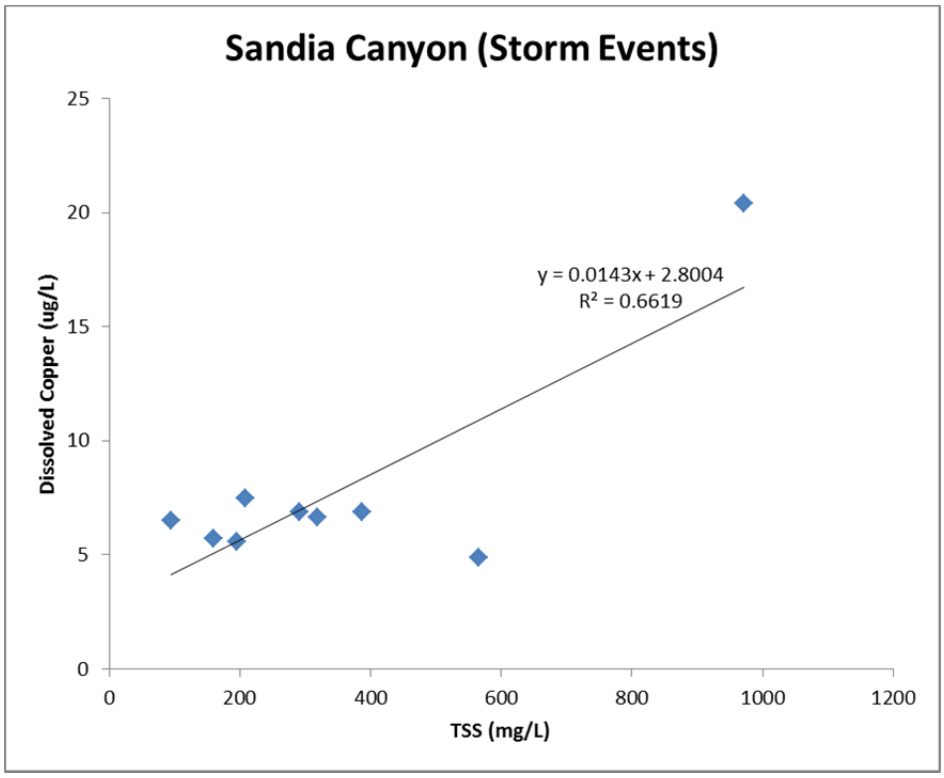

Figure 6 Relationship Between Dissolved Copper and Total Suspended Sediments

To estimate load allocations from non-point sources originating from developed sites at the head of the Sandia Canyon AU in TA-03, the Technical Release 55 (WinTR-55) model was used to calculate storm water discharge for a 0.5 inch precipitation event. A 0.5 inch event was selected because the frequency and magnitude is common on the Pajarito Plateau. Approximately 77 acres of drainage area from TA-03 were used in the calculations. The 77 acres represents a significant portion of the developed area at TA-03 and directly correspond to the sampling sites used to determine the Laboratory developed site runoff dissolved copper baseline values contained in Table 5a. Flows at these sites only occur only in response to precipitation events.

WinTR-55 is a single-event rainfall-runoff small watershed hydrologic model that can generate hydrographs from urban areas. The hydrographs are routed downstream through channels and/or reservoirs. Watersheds in WinTR-55 are composed of sub-areas (land areas) and reaches (major flow paths in the watershed). Each sub-area has a hydrograph generated from the land area based on the land use and climate characteristics input into the model. Reaches are designated as channel reaches where hydrographs are routed based on physical reach characteristics. Hydrographs from sub-areas and reaches are combined as needed to accumulate flow as water moves from the upland areas down through the watershed reach network. The accumulation of all runoff from the watershed is represented at the watershed Outlet.

For this application, the runoff from predominantly impervious areas upstream from Sandia Canyon, generated by a 0.5 inch storm event was calculated. The Outlet was the point of discharge into the head of Sandia Canyon. Model input data consisted primarily of land use details, storm data, and reach characteristics. Land use details included identification of the land cover type, size of the land cover (area), hydrologic soil group, and from these inputs the corresponding runoff curve number. Storm data included the rainfall distribution type and the 24-hr rainfall amount. Reach characteristics include flow type (channel, sheet, shallow concentrated), slope, and length of flow path.

The results of the model indicate that the estimated peak discharge from a 0.5 inch event over a 77 acre area in TA-3 (upstream from Sandia Canyon) is 7.25 cfs (4.6 MGD). The instantaneous discharge was used with the urban/developed baseline copper value of 34.1 ug/l to calculate the peak loading rate of 1.32lbs/day.

[4.6 mgd x 0.034 mg/L x 8.34 conversion factor = 1.32 lbs./day]

This is a first attempt to understand load contributions from a developed area at the Laboratory to the upper Sandia Canyon AU. The model estimated load was derived using runoff from an area of predominantly impervious surfaces located at the head of Sandia Canyon. Runoff from this area is primarily managed through conventional storm water systems (curb and gutter, drop inlets, culverts, etc.) which collect and concentrate runoff prior to discharge into the canyon. A 0.5 inch storm event falling on these impervious surfaces would be expected to result in a higher peak discharge rate compared with flows measured further downstream beyond the open channel and wetland within Sandia Canyon. The load contribution of 1.32 lbs/day was derived from this point of higher flowrate at the head of the canyon. A dissolved copper baseline value of 34.1 ug/L was established from storm water runoff at urban areas of the Laboratory.

Once runoff enters the canyon, the flowrate is reduced by increasing width of the conveyance (change from a pipe to an open channel configuration within the canyon), and through the impacts of infiltration and evapotranspiration, especially through the wetland area. The values in Figure 2 are derived from data measured at a location (E-123) on the downstream side of the wetland. A reduction in flowrate, from what is measured at the head of the canyon, is expected at E-123. A reduction in flowrate would correspond to a reduction in pollutant loading. Our model results supported this correlation. In addition the flow values used to develop Figure 2 include approximately 0.400 mgd in base flows from NPDES Outfall 011 which enters Sandia Canyon just downstream from the head of the canyon. This baseflow, in compliance with NPDES permit requirements, has very low copper levels. The addition of this baseflow to the storm water runoff from the impervious areas upstream further aids in a reduction of pollutant loading. The results of this modeled scenario demonstrate the impact on loading from a developed area at the Laboratory, provide support for the load allocation contributions from non-point sources outlined in Table 7, and support the correlation that existing topography and controls measures within Sandia Canyon utilized to influence flow rates can contribute to a reduction in pollutant loading within the AU.

The load duration curve in Figure 2 show a number of copper measured loads calculated from ambient water quality and the average flow on the date of the sample. In two instances the loads plot above the curve and indicate an exceedance of the water quality criterion. At flows of 1.49 mgd the target load was exceeded by 0.042 lbs./day and at flows of 0.538 mgd the target load was exceeded by 0.014 lbs./day. At the same time Figure 2 demonstrates that under similarly high flow conditions target loads were not exceeded. With the inherent uncertainty in load allocation amounts, it is difficult to accurately determine the reductions necessary to achieve target loading. However, reducing the load from high level flow events, in amounts corresponding to the target load exceedances of 0,014lbs/day and 0,042 lbs./day in

Figure 2, provides a basis for consistent achievement of target loading goals and represent the load reductions necessary to meet water quality standards. To the degree that sediment transport, generated by high flow events, can be further controlled, copper concentrations are likely to improve in storm water.

The collection of water quality data from E-123 and SCS-2 was temporarily disrupted due to the construction of the Sandia Grade control structure in 2013. Data collection will resume at these gages and used in future evaluations.

2.2 Point and Nonpoint Source Loading That When Implemented Will Achieve WQS

Describe the cause-and-effect relationship between the water quality standard (and numeric water quality targets as discussed above) and the identified pollutant sources and, based on this linkage, identify what loadings are acceptable to achieve the water quality standard.

Available data indicate the urban/developed landscape Laboratory property is a source of copper in the AU. The assertion that Storm water runoff from developed landscapes provides a source of copper is supported by the following:

- Of the 180 SWMUs and AOCs located in the AU, corrective action has been completed or delayed, or it has been determined that no further sampling for extent is required for 170 sites. Of the 10 remaining Sites, copper is a COPC in surface soils at two (6).
- The Sandia Canyon wetland sediments contain significant inventory of copper (7). The head-cut in the wetland may contribute to exceedances of the water-quality criteria at E-123.
- Copper is identified as a potential pollutant at only one MSGP facility, the TA-60 Material Recycling Facility (E122.35). Copper has not been detected above benchmark limits specified in the MSGP.
- Site-specific storm water run-on samples collected at IP locations S-SMA-0.25 and S-SMA-2 contained copper at 4.05–6.75 µg/L and 4.78– 21.3 µg/L, respectively (8).

2.3 Controls That Will Achieve Water-Quality Standards

Eventual attainment of the WQS is anticipated upon:

- Completion of the Sandia grade-control structure (Wetland Stabilization Project) and
- Continued application of NPDES permits and regulatory control already in place.
- Storm Water Management Plan

Samples associated with storm water flows were not recorded from the most downstream gage in the AU reach, SCS-2 Middle Sandia at WP Terminus. No exceedances of the dissolved copper water-quality criteria were in the 2008-2013 baseflow dataset for this station. A total of eight samples from storm water flows were recorded at E-123. With the limited data set it is difficult to determine if conditions are improving. A data set with samples from base flow and storm water conditions will continue to be developed.

It is understood that storm water urban runoff is a significant contributor to copper in the AU. Dissolved copper in storm water runoff is primarily bound with organic matter. The factors that govern the partition between dissolution, precipitation, adsorption, and redox processes, on the formation of the dissolved copper fraction in rain water and storm water, have not been specifically investigated at the Laboratory.

Monitoring for TSS and dissolved copper will continue at gages E121, E123 and SCS-2. The Background study is ongoing and expected to gather more information for baseline values from urban/developed areas. In FY-14 LANL initiated the review of Laboratory environmental policies, DOE orders, Engineering standards and environmental permits and evaluated the need for a Storm Water Management Plan for Technical Area 3. The plan is expected to include a monitoring component that will be used to define direct impacts from urban runoff. It is anticipated that monitoring will be conducted at multiple locations within the developed areas upstream from Sandia Canyon AU to collected first flush storm event samples. Results from these samples will be compared to baseflow and storm event samples from downstream gages to evaluate TSS-dissolved copper correlations.

The wetland area in upper Sandia Canyon is approximately 3.3 acres in size. In November the Sandia Grade Control Project was completed. One of the primary objectives was to better establish an even grade through the wetland to allow additional wetland expansion and further stabilization. The large amount of organic material can serve as a reducing environment which will promote the formation of more stable forms of copper-organic complexes. The wetland also reduces flow rate within the canyon and promotes sediment deposition. The wetland is an important historical sediment deposition area as the area contains approximately 80% to 90% of the inventory of copper within Sandia Canyon sediment deposits. Monitoring of the performance of the wetland to address dissolved copper concentrations will continue.

2.3.1 Point Source Controls

Three major NPDES permits provide the point source controls for the AU. The permits are specifically designed to monitor and prevent or reduce the amount of pollutants entering the AU. These programs contain mandated provisions and limits, with specified implementation time lines, to address impaired water conditions.

2.3.1.1 Industrial and Sanitary Point Source Discharge Permit (IPSP) Point Source Controls

The IPSP Discharge Permit is currently the only active NPDES Industrial and Sanitary Outfall Discharge Permit at the Laboratory. The effective dates of the permit were August 1, 2007, to July 31, 2012. The permit was extended on August 2, 2012 (EPA Region 6 to DOE/LANS) until a new permit is issued. The IPSP Permit includes 11 outfalls, three of which discharge to the upper AU. The locations of these outfalls are shown in the map in Appendix 1.

NPDES Outfall 001 is the main effluent source of water to Sandia Canyon and average discharges are approximately 268,000 gal. per day. Outfall 03A027 and 03A199 contribute less than 100,000 gal. per day. SERF went online in July 2012. SERF, located at the head of Sandia Canyon, provides tertiary treatment of the Sanitary Waste Water System (SWWS) facility effluent so that it can be reused/recycled as makeup water in the cooling towers at the Laboratory or discharged to NPDES Outfall 001. The facility is designed to treat water to meet effluent limitations set in NPDES Permit NM0028355. The facility utilizes chemical precipitation, flocculation, microfiltration, reverse osmosis, and pH adjustment.

In December 2007, the Laboratory completed the NPDES Permit Compliance and Outfall Reduction Strategy, which provided recommendations and options for the treatment, reduction, and/or elimination of the outfalls at the Laboratory. The report was prepared to assess the potential for outfall reductions in response to the more stringent effluent discharge limits provided in the IPSP. The number of industrial-wastewater outfalls has been reduced through active implementation of the outfall reduction strategy. A total of 17 outfalls discharging to Sandia Canyon have been eliminated. Two additional outfalls in the AU are identified for elimination/reduction over the next 2 to 5 yr. These include 03A027and 03A199, which will likely be connected to the SWWS Plant or directly to SERF.

As a condition of certification, NMED issued a state certification on September 19, 2013 requiring the permit to control copper pollutants which were above the current EPA Region 6 Minimum Quantification Level or MQL (0.5 ug/L) with effluent limitations at the Chronic Aquatic Life criteria in Outfall 001, 03A027 and 03A199 to ensure that NPDES permits are protective of State WQS. Hardness effluent characteristic of the discharge from Outfall 001 (78.8 mg/L) was used at all three outfalls to represent the receiving stream hardness and calculate the effluent limitations for the certification.

2.3.1.2 Individual Permit (IP) Point Source Controls Related to Certain RCRA SWMUs and AOCs

Section 1.3.1.2 provides an overview of the key provisions of the IP and the relationship to the Consent Order requirements, specifically the Upper Sandia Aggregate Area Supplemental Investigation (6). Table 3 lists the 9 SMAs with the 13 permitted sites in the IP for the AU. The map in in Appendixes 1 and 2 show the locations of the SMAs.

Site history and soil data collected for Consent Order investigations for the thirteen IP sites indicate that copper is not a significant industrial material at any of the sites in the AU. However, copper remains of concern at a number of IP sites because of TAL exceedences. On May 2, 2013, DOE/LANs issued the 2012 Update to the Site IP Discharge Pollution Prevention Plan for the Sandia/Mortandad watershed (11). The updated plan for 2012 describes the three main objectives:

- identify pollution sources,
- describe the control measures, and
- monitor to determine the effectiveness of controls at all regulated SWMUs and AOCs.

The annual report (12), issued in March 2014, presents activities and milestones accomplished during the period from January 1 to December 31, 2013, and includes a number of activities for the AU. SWMU and AOCs are grouped for investigation into watershed based geographic areas known as aggregate areas. The Upper Sandia Canyon Aggregate Area is located in TA-03, TA-60, and TA-61 at the Laboratory with a boundary approximately equal to the upper Sandia Canyon AU. Ongoing investigations to address SWMUs and AOCs within the upper Sandia Aggregate Area are subject to the Consent Order (3). The status of the investigation for these sites is as follows:

The Upper Sandia Canyon Aggregate Area consists of 180 SWMUs and AOCs:

- 91 were investigated and/or remediated before the March 2005 effective date of the Consent Order and have been approved for no further action.

The 89 remaining sites were investigated in 2009 and the results documented in the approved investigation report for Upper Sandia Canyon Aggregate Area (4).

- The approved investigation report concluded that additional sampling to define the nature and extent of contamination was needed for 41 SWMUs and AOCs. Additional sampling requirements for these 41 Sites were documented in the approved Phase II investigation work plan for Upper Sandia Canyon Aggregate Area (5).

- One additional Site (SWMU 61-002) was remediated before the 2009 investigation and results presented in a separate document.

Of the other 47 Sites included in the investigation report,

- corrective action complete status has been approved and certificates of completion issued for 24 Sites,

- further investigation will be delayed until decommissioning and demolition of associated buildings and structures at 21 Sites, and
- two Sites are being addressed under other regulatory programs.

In January 2012, after the investigation report and Phase II investigation work plan were approved, NMED and DOE entered into a framework agreement for the realignment of environmental priorities at the Laboratory. Under the framework agreement, NMED and DOE agreed to review characterization efforts undertaken to date pursuant to the Consent Order to identify those sites where the nature and extent of contamination have been adequately characterized.

The revised process did not affect the status of the 47 Sites approved for corrective action completion or delayed investigation or being addressed under other regulatory programs. The 2009 investigation data for the 41 Sites and data for from an additional Site remediated in 2005–2006 (SWMU 61-002) were reevaluated using this revised process, and the results are presented in the supplemental investigation report (6).

Based on the evaluation of investigation results using the revised process, no further sampling for extent is warranted at 32 Sites. The extent of contamination is defined.

Additional sampling is needed to define the extent of contamination for one or more inorganic chemicals for the following 10 Sites:

1. AOC 03-003(d)
2. SWMU 03-045(b)
3. SWMU 03-045(c)
4. SWMU 03-013(i)
5. SWMU 03-014(c2)
6. AOC 03-038(d)
7. SWMU 03-045(e)
8. AOC C-03-022
9. SWMU 60-007(a)
10. AOC C-61-002

Copper is a chemical of potential concern (COPC) in surface/near surface soils at SWMU 03-13(i), AOC 03-014(C2) and in deeper soils at AOC C-61-002. SWMUs 03-45(b), 03-045(c), and 03-014(c) are covered under the IP. No schedule for completion of corrective action is available for the 21 delayed sites, the 2 sites covered under other programs and the 10 sites where definition of extents is needed.

The IP contains non-numeric technology-based effluent limitations, coupled with a monitoring program, to measure pollutants in storm water discharges and determine where control measures may be needed. The IP requires the Laboratory to implement site-specific control measures (including best management practices) to address the non-numeric technology-based effluent limits as necessary to minimize pollutants in their storm water discharges. The current NPDES IP, incorporating the latest modifications, became effective on November 1, 2010, and expires on March 31, 2015 (10).

The site-specific control measures implemented across the 405 Sites under the IP along with the monitoring program are summarized in the annual update to the Site Discharge Pollution Prevention Plan (11) and the Annual Report (12). Baseline control measures were installed and certified at all 405 Sites to address the non-numeric technology-based effluent limits. These installations were completed within

the first 6-months of the permit that was issued 11/1/10. Photographs of these controls are at the website link provided. Both documents can be found on the IP's public website:

http://www.lanl.gov/community-environment/environmental-stewardship/protection/compliance/individual-permit-stormwater/index.php

2.3.1.3 Storm Water Multi-Sector General Permit Controls

The NPDES MSGP regulates storm water discharges from identified industrial activities and their associated facilities. Table 4 lists the MSGP facilities and frequency and number of monitoring samples for outfalls discharging storm water to the AU and the maps in Appendix 1 and 3 show the location of these MSGP. MSGP regulated activities within the AU include metal fabrication; vehicle and equipment maintenance; recycling activities; electricity generation; and warehousing activities. LANS and the DOE are permitted under the EPA 2008 NPDES Storm Water MSGP for Industrial Activities (the 2008 MSGP). The current MSGP was effective September 29, 2008, and expired on September 29, 2013. A draft MSGP has been issued by EPA but not yet finalized. It is anticipated that a new permit will be issued by EPA in 2014. Administrative continuance of the 2008 MSGP will occur until a new permit is issued.

The MSGP requirements include the implementation of control measures, development of facility-specific Storm Water Pollution Prevention Plans (SWWPPs), Corrective Action requirements for identified issues, and monitoring storm water discharges from permitted outfalls. Compliance with these requirements is achieved primarily by:

- Identifying potential pollutant sources and activities that could adversely impact water quality.
- Identifying and providing structural and nonstructural controls to limit the impact of potential pollutants,
- Developing and implementing facility-specific SWPPPs,
- Implementing permit-specified Corrective Actions for any identified issues,
- Monitoring storm water runoff for industrial sector-specific benchmark parameters, impaired water constituents, and effluent limitations, and
- Visually inspecting storm water runoff to assess color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of storm water pollution.

Minimizing the exposure of potential pollutant sources and activities to storm water is primarily achieved through administrative controls associated with work processes and engineering controls such as covering, secondary containment, berms to direct runoff flow, and storm drain inlet protection. Erosion and sediment transport at facilities is also monitored and addressed through the implementation of structural controls or stabilization of areas with asphalt, concrete, or perennial vegetation.

Evaluation of storm water monitoring results is performed to identify the need to modify existing controls or implement new controls. Storm water monitoring under the 2008 MSGP was initiated in April 2009. Monitoring results for copper since this time have been below either the MSGP sector-specific benchmarks or the LANL specific background value for storm water. In accordance with the MSGP requirements, monitoring for copper has been eliminated at all the MSGP facility outfalls that have had storm water discharges to the Sandia Canyon AU. This reduction in sampling has been achieved by eliminating processes and pollutant sources, and by documenting that pollutants are below benchmark or background levels.

Activities and operations at MSGP facilities are regularly evaluated for compliance with the MSGP requirements through formal inspections, quarterly visual assessment of storm water discharges, and informal walk-arounds. For MSGP facilities where storm water analytical monitoring has ceased, if there

is new construction or a change in the operation or maintenance at the facility that significantly changes the nature or quantity of pollutants discharged in storm water, the facility will be reevaluated and modifications will be made, including possibly resuming analytical monitoring. Additionally, quarterly visual assessments of storm water discharges are conducted even if analytical monitoring has ceased. If either the visual assessments or facility inspections indicate that control measures may not be stringent enough for the discharges to meet applicable water quality standards, necessary adjustments or modifications, including resumption of analytical monitoring, will be implemented.

2.3.2 Non - Point Source Controls

A number of non-point source controls have been established in the upper Sandia Canyon AU. Of particular importance to non-point source mitigation, is the newly completed Sandia Grade Control Structure. Completed in November of 2013, it is still too early to determine its effectiveness in controlling sediment and contaminant migration. However, it is expected, along with other controls, to reduce dissolved copper levels at E-123 and SCS-2.

2.3.2.1 Sandia Wetland Stabilization Project

The Sandia Canyon wetland is located within the AU below the primary developed Laboratory area in the upper watershed and approximately 100 yards above monitoring station E-123. A large head cut formed in the lower section of the wetland, resulting in increased sediment migration downcanyon. The wetland is an important historical sediment deposition area. The highest concentrations of copper in the AU are located in the wetland reach (7). The head cut in the lower section of the wetland was stabilized by constructing a three stepped grade-control structure that will allow a grade transition from the current elevation of the wetland to the stream bank near stream gage E-123. The area behind the grade-control structure was backfilled and wetland vegetation was planted to allow expansion of the wetland area. These measures will physically stabilize the wetland by reducing sediment and associated contaminant transport into the lower sections of the canyon.

The grade-control structure was designed to meet the following objectives:

- Provide and even grade to allow wetland expansion and further stabilization
- Be sufficiently impervious to prevent the draining of alluvial soils
- Facilitate nonchannelized flow
- Minimize erosion during large flow events
- Support wetland function under reduced effluent conditions

A 25-year, 2-hour storm event with a peak design flow of 500 cubic feet per second was used for the design of the grade-control structure as required by the Laboratory's design guidance. The primary goal was to reduce the stream velocity in the area of the grade control structure to less than 6 feet per second. Construction of the grade-control structures was completed in November 2013. Final stabilization of the site (vegetative growth) is expected in summer of 2014.

Construction of the grade-control structure was required based on the results of investigations conducted under the Order on Consent (Consent Order), which provides the time table and requirements for environmental cleanup of hazardous constituents for the Laboratory. Monitoring pursuant to Consent Order requirement will be conducted as follows:

- Surface water monitoring of base flows at gages upstream and downstream of wetland. Baseflow sampling will occur quarterly.

- Storm water samples will be collected in response to storm events from gages upstream and downstream of wetland
- Vegetation monitoring will be conducted via semi-annual photo surveys
- A series of repeat cross sections will be established to document annual geomorphic changes

This data will be reported to NMED annually.

The project was permitted under Section 404 of the Clean Water Act - the U.S. Army Corp of Engineers (ACOE) Nation-Wide Permit #38 for Cleanup of Hazardous and Toxic Waste. The ACOE required compensatory mitigation and accepted DOE/LANS performance standards and monitoring plan to measure performance. Performance standards include:

- Vegetation in wetland disturbed area recovers to ≥60% native species absolute cover
- Extent of wetland facultative and obligate vegetation west of grade control structure does not decrease below current wetland size (2.97 acres)
- Percent relative cover of wetland facultative and obligate vegetation within delineated wetland boundaries does not decline more than 15% from baseline in years following installation of grade control structure

Monitoring requirement includes:

- Photo documentation
- Vegetative species and cover qualification
- Extent of wetland vegetation
- Water level monitoring

An annual report of the monitoring results will be prepared using the U.S. Army Corps of Engineers format and will be delivered by November 30 of each year. Reporting will continue for 5-years or until LANL is notified by the ACOE that reporting is no longer required.

The installation of the Sandia Canyon grade control structure is subject to the NPDES Construction General Permit. Final stabilization will not be complete until the summer of 2014. This project and the adjacent Sandia Canyon Stabilization Access Road are currently the only CGP-permitted projects within the AU.

2.3.2.2 Storm water Controls/Management from Developed Laboratory Areas

Controls within the LANL area primarily consist of several small detention ponds, riprap structures at various discharge locations, and a grade control structure within Sandia Canyon. The detention ponds capture runoff from adjacent buildings and surrounding impervious areas, and discharge flow through controlled outlet structures. These ponds are designed to manage runoff velocity to pre-development levels and also facilitate the settling and capture of sediment transported in storm water runoff. As an example, a bio detention pond is currently being constructed within LANL's primary administration area to address runoff from a large parking structure and an adjacent parking lot. The pond will minimize runoff velocity and is designed with a forebay to capture "first flush" sediments and manage site snow removal. This system will provide a first flush treatment before site runoff enters the existing storm drain infrastructure system.

Riprap is placed at various discharge locations to reduce runoff and minimize the potential for erosion within and adjacent to Sandia Canyon. For example, both surface runoff and flow collected in the storm drain infrastructure system from a significant portion of the LANL area discharge directly at the head of Sandia Canyon. A riprap structure and a small riprap basin have been installed at this discharge location

to manage these flows. The riprap reduces runoff velocity in the flows prior to discharge into Sandia Canyon.

Approximately 0.7 miles downstream from the head of Sandia Canyon, a grade control structure has been installed within an existing wetland. This wetland is an important historical sediment deposition area, as the highest concentrations of copper in the AU are located within the wetland reach of the canyon. A large head cut formed in the lower section of the wetland, resulting in increased sediment migration downcanyon. The grade control structure, consisting of a series sheetpile structures designed to reduce flow velocity and increase the width of flow within the watercourse, will stabilize the head cut by facilitating a grade transition from the current elevation of the wetland to the downstream channel. The area behind the sheetpile structures was backfilled and wetland vegetation is being established in these areas. A cascading drop pool constructed with rock at the downstream end of the grade control structures serves as a final energy dissipater for the water flow. By reducing flow velocity and enhancing the sustainability of the wetland, this grade control structure will stabilize existing soils and enhance future sediment deposition, thereby maintaining hydrologic and geochemical conditions that will minimize the migration of pollutants of concern including copper.

Additional controls to address non-point sources are also forthcoming. Several landscaping projects are currently being planned for locations within the LANL area of the Sandia Canyon watershed. These projects will incorporate Low Impact Development features to minimize on-site runoff and downstream erosion potential. Implementation of these projects will further enhance existing non-point source control.

The development and execution of an urban storm water management plan for the LANL is a key to addressing non-point source contamination and eventual attainment of water quality standards in the upper Sandia Canyon Assessment Unit (AU). Storm water urban runoff is a significant contributor to copper in the upper Sandia Canyon Assessment Unit (AU). In FY-14 LANL initiated the review of Laboratory environmental policies, DOE orders, Engineering standards and environmental permits and evaluated the need for a Storm Water Management Plan for Technical Area 3 (TA-03). TA-03 is highly developed area at LANL and located in the headwaters to the AU.

For FY-15 LANL will request funding for the development of a pilot TA-03 Storm Water Management Plan. If funded, the plan will be fashioned to provide an integrated approach to storm water management and include the following objectives:

- Maintain compliance with current and future storm water regulations.
- Create a storm water planning process involving multiple organizations and integrate into comprehensive planning process.
- Identify and implement storm water management practices that facilitate compliance and address nonpoint source contaminant transport and increases in storm water discharge, channel erosion and sediment transport.
- Identify storm water runoff locations.
- Identify potential pollutant sources affecting water quality.
- Identification of appropriate Best Management Practices and control measures for both current and future sites and activities.
- Increased controls to manage storm water runoff from urban and developed areas on Laboratory property.

2.3.2.3 Storm water Controls/Management from Urban Townsite in Upper Watershed

Los Alamos County property discharging to Sandia Canyon is comprised of approximately 23 acres at the former municipal landfill site and 6 acres within the Royal Crest housing area. The landfill site has a soil

cap and operates under a closure plan. At the east end of the site, the ground cover consists of sparse native perennial vegetation and approximately 3.5 acres of compacted basecourse housing a solar array. The west side of the site is primarily a flat area of compacted soil with light industrial activity. With the exception of a small area at the east end of the landfill site, the slopes along Sandia Canyon are stabilized with native perennial vegetation.

Within the Los Alamos County landfill site four rock lined open channel structures collect and convey runoff to Sandia Canyon. Three of the four structures discharge at locations upstream of the grade control structure. Runoff in remaining areas is conveyed to the canyon in multiple locations via sheetflow or minor concentrated flow. The six acre site within the Royal Crest housing area has a system of storm drains that collect runoff from streets and surrounding structures and discharges runoff through a single culvert.

Controls within the Los Alamos County area consist primarily of maintenance of the landfill cap, compliance with the landfill closure plan, and erosion control structures on the east end of the landfill site. Previously, a significant portion of the runoff from the eastern half of the landfill site, from a single drainage area, was conveyed in rock rundowns to a single discharge location due north of the grade control structure. Significant erosion of the canyon slope at this discharge location was occurring, resulting in discharges of sediment into Sandia Canyon. Los Alamos County has initiated work to subdivide the current single drainage area on the east end into two basins, resulting in two new discharge locations. New riprap channels will convey runoff to small basins at these discharge points, facilitating additional reduction of runoff velocity prior to discharge. Creating new discharge locations also bypasses the existing eroded slope, minimizing sediment transport into Sandia Canyon. The landfill is owned by Los Alamos County and is now closed and operating under a NMED approved closure plan. A leachate collection system is not in place. The Laboratory is not aware of any reports or documentation indicating leachate from the landfill is impacting the upper Sandia Canyon AU.

In addition to the drainage modification on the landfill site, a large retention structure has been constructed within Sandia Canyon, on the north side of the grade control structure, to capture runoff from approximately five acres of the landfill the landfill. This structure is located within the area of the eroded slope and will retain runoff from the eroded area as well as the concentrated flow from one of the new discharge points. The structure has a controlled outlet and is designed to retain runoff from a 100-year storm event. For events of smaller magnitude this structure will prevent runoff from the landfill from reaching the water course within Sandia Canyon.

2.4 Description of Requirements under Which Pollution Controls Will Be Implemented

The demonstration should describe the basis for concluding that the pollution controls are requirements or why other types of controls already in place may be sufficient.

The programs and permits described above are based on specific requirements contained in the federal CWA or New Mexico State law. NPDES pollution controls and regulatory requirements described are specifically designed with the objective of meeting WQS at the point of compliance. Permit conditions and requirements are tailored specifically for discharges to impaired waters. The Consent Order (3) is the principal regulatory driver for the Laboratory's environmental restoration programs and requires the investigation and, if necessary, remediation of SWMUs and AOCs located on Laboratory property.

3. ESTIMATE OR PROJECTION OF TIME WHEN WQS WILL BE MET

The demonstration should provide a time estimate by which the controls will result in WQS attainment, including an explanation of the basis for the conclusion.

For copper, where a Laboratory source is identified, the controls in place are estimated to achieve WQS within two assessment cycles (4 years). The time frame will allow implementation of control measures and confirmation monitoring against water-quality criteria. The time frame will also facilitate coordination with listing cycles. Where the pollutant has no known anthropogenic source or where significant contributions originate from natural background sources, site-specific water quality criteria may be warranted as provided for in 20.6.4.10 NMAC (2).

The development and execution of an urban storm water management plan for the Laboratory is a key to addressing non-point source contamination and eventual attainment of water quality standards in the long-term. In FY-14 LANL initiated the review of Laboratory environmental policies, DOE orders, Engineering standards and environmental permits and evaluated the need for a Storm Water Management Plan for Technical Area 3 (TA-03). TA-03 is highly developed area at LANL and located in the headwaters to the AU. For FY-15 LANL will request funding for the development of a pilot TA-03 Storm Water Management Plan. If funded, the plan will be fashioned to provide an integrated approach to storm water management. The plan will be continually reviewed to determine if and where revisions may need to be made to eliminate conditions, prevent reoccurrence, and ensure that water quality standards are attained.

4. SCHEDULE FOR IMPLEMENTING POLLUTION CONTROLS

The demonstration should describe, as appropriate, the schedule by which the pollution controls will be implemented and/or which controls are already in place.

The schedule for implementation of pollution controls is set by the NPDES permits or regulatory requirements. Each permit or regulatory requirement imposes some combination of effluent limits, compliance schedules, monitoring requirements, enforcement provisions and compliance time frames. The current schedule for these programs is as follows:

- NPDES Industrial Outfall Permit (IPSP) Effective 2013–2018
- NPDES Storm Water Individual Permit (IP) Effective 2010–2014
  - Reapplication Submitted March 27, 2014
- NPDES Storm Water MSGP Effective 2008–2013 (anticipated 2014)
- Sandia Wetland Stabilization Project Complete in November 2013
  - ACOE Monitoring Requirements and Reporting Annually from November 2014 to 2019
  - Consent Order Monitoring and Reporting Annual Reporting
- Consent Order Corrective Action 2005–2015
- NPDES – Construction General Permit Effective 2012–2018
- Clean Water Act 404 Permits Effective 2012–2017
- LANL Storm Water Management Plan Development Planned for 2015

5. MONITORING PLAN TO TRACK EFFECTIVENESS OF POLLUTION CONTROLS

The demonstration should include a description of, and schedule for, monitoring milestones to track effectiveness of the pollution controls. The demonstration should describe water quality monitoring that will be performed to determine the combined effectiveness of the pollution controls on ambient water quality.

To track the effectiveness of the 4b Demonstration, the watershed-based gage stations E121, E123 and SCS-2 will continued to be monitored under the Laboratory's environmental surveillance activities during both baseline conditions and storm events. The collection of water quality data from E121, E-123 and SCS-2 was temporarily disrupted due to the construction of the Sandia Grade control structure in 2013. Data collection will resume at these gages and used in future evaluations.

Monitoring occurs at these gages pursuant to the Interim Facility-Wide Groundwater Monitoring Plan and in response to storm events as follows:

Gage	Flow	Metals (including dissolved copper)	General Inorganics	TSS/SSC
E-121 (S-SMA-2) Sandia Right Fork @ Power Plant (above wetland)	Continuous	Quarterly and in response to storm events	Quarterly and in response to storm events	Quarterly and in response to storm events
E-123 Sandia Below Wetlands	Continuous	Quarterly and in response to storm events	Quarterly and in response to storm events	Quarterly and in response to storm events
S-SCS-2 Middle Sandia Canyon @ Terminus of Persistent Base Flow		Quarterly and in response to storm events	Quarterly and in response to storm events	Quarterly and in response to storm events

These gages are part of the Laboratory's Environmental Surveillance Program (ESP). The ESP has sampled and analyzed sediments and surface water in Sandia Canyon since approximately 1970. This work, reported in annual Environmental Reports, supports the evaluation of long-term trends in contamination in different media and understanding of the role of storm water transport.

In addition to the ongoing surveillance activities, information specific to the pollutants causing impairment will be collected and analyzed. These data will be continuously analyzed and used to evaluate the effectiveness of the 4b Demonstration and support listing decisions for the development of the Integrated List.

Additionally, the permits and regulatory controls in place provide specific time frames and regulatory deadlines to ensure permit milestones are achieved.

Surface water monitoring and assessments at the Laboratory occur at several levels.

1. The annual Interim Facility-Wide Groundwater Monitoring Plan (IFGMP or Interim Plan) includes monitoring of base flow or persistent surface water in main drainages and some tributary channels for an extensive list of constituents.

2. Sampling of snowmelt runoff and storm water at gaging stations occurred as part of the Laboratory's environmental surveillance activities.

3. Storm water sampling at locations and frequencies specified in the IP.

4. Ongoing storm water sampling at MSGP regulated facilities per the requirements of and at frequencies specified in the MSGP.

5. On-going monitoring to determine compliance with Industrial Outfall permit limitations.

6. Continuation of storm water sampling as part of a special study to evaluate background and baseline concentrations of PCBs, metals, and gross-alpha radiation in and near the Laboratory.

The demonstration should identify how and when assessment results from the monitoring will be reported to the public and USEPA.

The Laboratory's environmental data records are available on a single cloud-based, web-accessible system to the public. The cloud-based data system houses more than 12 million records, including 27,000 locations and 250,000 samples. All sampling locations used in the 4b Demonstration are available to the public. The publicly available view of the database requires no feeds or transformations of the data. The site can be accessed at http://www.intellusnmdata.com/.

The annual Environmental Surveillance Report is prepared pursuant to DOE Order 450.1. The report summarizes environmental data that are used to determine compliance with applicable federal, state and local environmental laws and regulations, executive orders, and departmental policies. Additional data, beyond the minimum required, are also gathered and reported as part of the Laboratory's efforts to ensure public safety and to monitor environmental quality at and near the Laboratory. A summary of 4b measures and effectiveness will be included in the Watershed chapter. The most recent report, issued in September 2013, is for the 2012 calendar year (13). The report can be accessed at http://www.lanl.gov/community-environment/environmental-stewardship/environmental-report.php.

The AU downstream of the upper Sandia Canyon AU is NM-128.A_11 Sandia Canyon (within LANL below Sigma Canyon). The designated uses are: 1) limited aquatic life, 2) livestock watering, 3) secondary contact, and 4) wildlife habitat. The designated use not supported is limited aquatic life. In the draft 2014 Integrated report dissolved copper is removed as a parameter associated with non-attainment. Improvements in water quality criteria in the upper AU are expected to be protective of the lower Sandia Canyon AU. Results of base flow samples at gage S-SCS-2, which is located at the downstream end of the upper AU, show attainment of the acute dissolved copper criteria. Use of this gage was discontinued in 2012 and did not capture storm events for the period. As part of this demonstration, the gage will be activated to capture both baseflow and storm events and used to evaluate potential impacts to the lower AU.

6. COMMITMENT TO REVISE POLLUTION CONTROLS, AS NECESSARY

The demonstration should provide a statement with a commitment to revise the pollution controls, as necessary, if progress towards meeting water quality standards is not being shown.

DOE/LANS will comply with permit conditions and limitations. In the event that progress towards meeting water-quality targets is not being achieved, changes in permit and regulatory requirements may be sought. NPDES permits provide an array of procedures and mechanisms to measure and ensure progress is achieved, including (1) schedules of compliance, (2) compliance status reports, (3) reopener clauses, (4) inspections, and (5) reporting requirements. Permit limits and conditions may be changed by EPA. Under section 401 of the CWA, NMED certifies that permitted activities will comply with New Mexico WQS. As previously stated, the development and execution of an urban storm water management plan for the LANL is a key to addressing non-point source contamination and eventual attainment of water quality standards in the upper Sandia Canyon Assessment Unit (AU). With a projected implementation time-frame of 2015, the storm water management plan will take an adaptive management approach and will include an extensive monitoring component. This plan will aid in further identifying storm water runoff locations, quantifying runoff volumes, identifying potential pollutant sources affecting water quality, and assisting in the identification of appropriate Best Management Practices and control measures for both current and future sites and activities. The plan will be continually reviewed to determine if and where revisions may need to be made to eliminate conditions, prevent reoccurrence, and ensure that water quality standards are attained.

7. REFERENCES

The following list includes all documents cited in this report. They can be accessed at the following links: Documents prepared under the Individual Permit are available at http://www.lanl.gov/community-environment/environmental-stewardship/protection/compliance/individual-permit-Storm water/documents.php, *and documents prepared under the Consent Order are available at the Electronic Public Reading Room,* http://www.lanl.gov/community-environment/environmental-stewardship/public-reading-room.php#.Un0T_3eK7Dt.

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3. NMED (2005 and 2012 revision). Compliance Order on Consent – The United States Department of Energy and the Regents of the University of California

4. LANL (2010). Investigation Report for Upper Sandia Canyon Aggregate Area, Revision 1, Los Alamos National Laboratory document LA-UR-10-6410, Los Alamos, New Mexico.

5. LANL (2011). Phase II Investigation Work Plan for Upper Sandia Canyon Aggregate Area, Los Alamos National Laboratory document LA-UR-11-2178, Los Alamos, New Mexico.

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13. LANL (September 2013), Los Alamos National Laboratory Environmental Report 2012, Los Alamos National Laboratory document LA-UR-13-27065, Los Alamos, New Mexico.